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AGRICULTURAL ECONOMICS RESEARCH

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Economic Research in the Department of Agriculture: A Historical Perspective

By Gladys L. Baker and Wayne D. Rasmussen

Economic research in the U.S. Department of Agriculture (USDA) has achieved its greatest recognition in periods when agriculture and farmers have experienced stress and change. In 1922 the Bureau of Agricultural Economics (BAE) was set up in the Department to help find solutions to the disastrous post-World War I drop in farm prices. After BAE's solutions proved politically unacceptable, the Bureau focused mainly on economic analyses and market studies, and it handled most of USDA's work on standards, grades, crop and livestock estimates, foreign agriculture, and some other subjects. BAE's position reached a high point in the 1930's when its data and economic analysis formed the basis for major New Deal programs and policies. It was given responsibility for general planning in 1939. During World War II, it served war agencies as well as USDA, but afterward its influence declined because of effective opposition to some of its activities, including program planning. With its dissolution in 1953, economic research was divided between two USDA agencies and removed from policy planning. In 1961, the Economic Research Service was established. Currently, it supplies basic economic data, evaluates policy when asked to do so, and provides prompt answers to pressing economic questions.

Agricultural economics provided one answer to the political unrest of farmers in the 1890's and early 1900's. If farmers had not attained their goals through political action to influence prices, perhaps they could do so individually by applying economic ideas to their farm operations. In 1911, Henry C. Taylor, who defined agricultural economics as a distinctive field of research, wrote that its function was "to secure maximum net profits for the farmer and maximum well-being for the nation" (*19*).

The new discipline combined several lines of work. The gathering of agricultural statistics had been a major line of work of the U.S. Department of Agriculture (USDA) since its beginning in 1862. Before that, such efforts had been handled in the Agricultural Division of the Patent Office.

Farm management first developed in USDA, beginning in 1901, under the leadership of an agronomist, W. J. Spillman. Studies were made of farming conditions and practices, especially on the most successful farms, and plans were then prepared to help farmers adopt more efficient systems of farm management. This work was organized in 1905 as the Office of Farm Management (*5*, pp. 44-45).

Other lines of agricultural economic work were growing out of recommendations of the Country Life Commission. In 1913, both a Rural Organization Service and an Office of Markets were established in the Department. The first was to study rural economic problems in a broad way; the second was to carry out research, service, and regulatory work in marketing. In 1915, the two organizations were merged (*5*, pp. 73-80).

Meanwhile, Taylor had been developing agricultural economics as a field of research at the University of Wisconsin, publishing the first agricultural economics textbook in 1905. A number of his students joined the USDA staff and he himself worked for the Department on the economics of irrigation and for the Census Bureau in planning the 1910 agricultural census. In 1919, Secretary of Agriculture David Houston appointed a committee of agricultural leaders to consider broadening the Department's work in farm management. As a result, the Office of Farm Management and Farm Economics was established on July 1, 1919, and Taylor was appointed chief. He became chief of the newly established Bureau of Markets and Crop Estimates on July 1, 1921, even as he continued on his previous job. All economic work was to be combined as soon as the Congress authorized Secretary Henry C. Wallace to take action (*5*, pp. 107-108).

THE BUREAU OF AGRICULTURAL ECONOMICS

Origin and Objectives

The Bureau of Agricultural Economics (BAE) was established in 1922, a time of serious economic crisis for farm people. Secretary Henry C. Wallace, who consolidated the Department's economic activities in the new bureau, believed that if agricultural economists focused their research on the task, they could help farmers solve their price and income problems. He challenged agricultural economists to give up the detached seats of observation from which they hoped to provide the records to enable future economists to explain what had happened. Instead, he maintained, let them turn to research with the definite objective

of helping struggling farmers "work out their problems, not alone for their benefit, but for the benefit of the nation." A national program, he told them, should include consideration both of what was practical to do and what ought to be done to help agriculture bridge over the depression and build a stable and sound agriculture for the future (*43*).

As one of his first actions upon taking office, Wallace inquired into the economic work being carried on in the Department. On May 25, 1921, he appointed an economics committee of five bureau chiefs. He directed them to make a study of the economic conditions of agriculture, consult with agricultural economists from around the country, and draw up recommendations for handling the problems encountered. Henry C. Taylor, then Chief of the Office of Farm Management and Farm Economics and a friend of the Wallace family, had previously prepared a plan that would consolidate all economic work into a new Bureau of Agricultural Economics.

The committee of bureau chiefs, the outside agricultural economists, the farm organization leaders, and members of the agricultural committees of Congress who were consulted approved the proposal for consolidation. However, some members of Congress protested that the name "agricultural economics" was a "high-brow collegiate term" that would not mean anything to farmers. Secretary Wallace and Henry C. Taylor, who by this time was Chief of the Bureau of Markets and Crop Estimates, stated that agricultural economics was the one name that embraced all the activities and that it had the advantage of brevity. Taylor suggested that agricultural economics was also the most satisfactory name from the scientific point of view. He pointed out that the consolidation would allow for more effective organization of interrelated work. As an example, he said that he had found within the Department five different offices in three separate organizations studying price relations. By getting the eight or nine people working on the problem together and organizing a committee on price relations with a chairman in charge, the work could be done more effectively and efficiently.

Secretary Wallace defined the objective of the new bureau as inquiring into "every economic condition and force which has an influence upon either production or price, for the one depends upon the other." He stated that the work would begin with the study of farm management. The costs of production and distribution would be studied at each stage along the way. Marketing, he felt, was as truly a part of production as the growing of crops. The ultimate purpose of all the research, he suggested, was "to make sure that our people are abundantly supplied with the products of the soil at prices which will both sustain our agriculture and be just to the consumer" (*31*, 1923, pp. 512-560, 848-850; *32*, 1923, pp. 57, 511-512).

As a result of efforts by Wallace, Taylor, and the committee of bureau chiefs, the Bureau of Agricultural Economics was established in 1922. To head it, Secretary Wallace selected Henry C. Taylor, who had pioneered in the development of farm management and agricultural economics. In his testimony on February 9, 1922, before the House Subcommittee on Appropriations for the Department of Agriculture, Taylor said:

> The real work of the new Bureau of Agricultural Economics is to put the farmer and the dealer in farm products in possession of the facts they need in order to act wisely in all these problems of production and marketing and to provide such service and supervision as will tend to establish efficiency and fair play in the marketing of farm products.

Marketing work had developed rapidly in those areas which promised to give immediate aid to farmers, such as the market news service and inspection work. The next important step, he suggested, was to develop research work in the economic problems of production and marketing.

The appropriation request divided the work of the Bureau into four categories: (1) farm management and farm practice, (2) cost of production and distribution, (3) marketing and distribution, and (4) foreign production and distribution (*31*, 1923, p. 512; *32*, 1923, p. 57).

As first organized, the Bureau of Agricultural Economics had three production divisions: farm management; cost of production; and crop and livestock estimates. The marketing divisions included: cost of marketing, warehousing, city markets, and six commodity divisions. General divisions were agricultural finance; statistical and historical research; agricultural cooperation; farm population and rural life; land economics; and information. The Washington office had 990 employees and the field organization, with 148 branch offices in 79 cities, had 936 workers. The field staff and many of the employees in the Washington office were primarily concerned with regulatory and marketing services, which had grown out of research, rather than with research. However, a close interrelationship existed between these services and research. Henry C. Taylor, as bureau chief, had two assistant chiefs, Lloyd S. Tenny and William A. Schoenfeld, and a director of information (*36*, 1923, pp. 6-71).

During the first years of the Bureau, research emphasized the collection and analysis of data on production, price, and market for farm products. According to Taylor, the problem of adjusting the farmer's work to the market influenced research throughout the whole bureau. This problem required studies of demand, prices, costs, and other factors.

If the research was to benefit the farmer, the facts collected and their interpretation and analysis had to be made available in a form farm people could use. On April 20 and 21, 1923, the Bureau held the first of a still continuing series of annual outlook conferences. It was attended by statisticians and economists from the Bureau of Agricultural Economics, the Department of Commerce, the Federal Reserve Board, and nongovern-

ment research agencies. BAE's Division of Statistical and Historical Research prepared a summary of agricultural statistics for use by conference participants. Committees of conference participants were asked to prepare statements which would provide a basis for action by farmers to adjust production to probable market conditions.

The first outlook conference was based largely on the statistics obtained from crop reports. It was recognized that additional research on supply, demand, and price was needed as a basis for outlook reports. Further, studies should be made of the effect of industrial prosperity and employment on the demand for specific farm products. If farmers were to make changes in the use of their land, they needed more information on alternative crops which were in demand.

The agricultural outlook work guided research into new channels. It also resulted in regular publication of research results in a form that could be better understood by county agents, farm journalists, and others who could reach individual farmers. Summaries of research results first appeared on a regular basis in *Weather, Crops, and Markets* and *The Agricultural Situation.*

Secretary Wallace and Taylor hoped that farmers, if they had the benefit of facts and forecasts, would be able to independently plan their farming operations not based on prices at planting time but on probable prices at selling time. Taylor suggested that if production was orderly the problem of selling should become relatively simple. It was hoped that the policy of providing information to form a basis for individual and collective action would bring about over a period of time the necessary agricultural readjustments. The Bureau was providing both information and service in the form of technical advice to groups desiring to organize cooperatives and to individual cooperatives. Growth and readjustments in population would, Taylor believed, also help to bring about gradual recovery from the existing agricultural depression (*25*, *41*, 1923, pp. 21-22; *28*; *34*).

Early Political Involvement

The organization of the outlook service and the quality of research conducted by the Bureau contributed to Secretary Wallace's feeling that setting up the Bureau had been his most important accomplishment during his first year in the cabinet. But when agricultural conditions did not improve, he began to push BAE Chief Taylor to consider more drastic measures for solving the farm problem. In the spring of 1923, he asked how much wheat would have to be disposed of abroad to get rid of the surplus through an export corporation, as proposed in a bill introduced by Senator Norris. Statisticians estimated that about 50 million bushels would need to be exported.

In September, Secretary Wallace called in Taylor and challenged him further to help find a solution. According to Taylor, the Secretary said:

> . . . while we as department workers should adhere to the national point of view, which we are certainly doing in striving to save agriculture from destruction, it does not follow that farmers as a class must adhere to the national point of view when other groups are not doing so. In fact, unless farmers as a class get busy and *fight* for their rights we in the Department will not long be able to take a national point of view because the point of view of other interests will dominate us.

In his response, Taylor outlined several possible attacks on the price ratio problem. The one that appealed most to Secretary Wallace (and to which he was probably already committed) called for the organization of an export commission to make the Nation's tariffs work in agriculture's behalf (*26*, pp. 591-595).

George N. Peek and Hugh S. Johnson, officials of the Moline Plow Co., had been vigorously promoting such a plan for several years with an eye to bringing about "equality for agriculture." Wallace now directed a BAE consultant, Charles J. Brand, former Chief of the Office of Markets, to draft tentative legislation incorporating the Peek-Johnson ideas. This bill, reworked by the Senate and House drafting sections in 1924, was introduced into Congress as the McNary-Haugen bill by Senator Charles L. McNary of Oregon and Congressman Gilbert H. Haugen of Iowa. Brand had the task of lobbying for enactment of the measure (*16*, pp. 38-59; *48*, pp. 267-279).

Meanwhile, Taylor had fallen on hard times in the Department. President Coolidge first accused him of using a fact-finding trip to the Wheat Belt to stir up protest against the administration's policies. Then on October 24, 1924, Wallace died, leaving Taylor in an untenable position. The new Secretary, Howard M. Gore, former Governor of West Virginia, did not press the bureau chief to resign. But Gore's successor, William M. Jardine, who took office on March 5, 1925 as a strong opponent of the McNary-Haugen bill, wanted Taylor out. Taylor protested vigorously but ineffectually, refusing to resign. He was replaced in August 1925 by Thomas P. Cooper, dean of the college of agriculture and director of the agricultural experiment station at the University of Kentucky (*21*, pp. 259-262; *48*, 243-244).

Emphasis on Cooperative Marketing

While Cooper was in office, Congress, by the Cooperative Marketing Act of July 2, 1926, created a division of cooperative marketing in the Bureau of Agricultural Economics, replacing the Division of Agricultural Cooperation. The new division was to carry out research, and provide advisory service and educational assistance to associations of producers engaged in cooperative activities. It was also directed to advise groups of producers interested in forming cooperatives. Establishment of the division by the Congress agreed with Secretary Jardine's position that cooperatives offered farmers

an effective means of coping with the problem of surplus production.

With this enphasis on cooperative marketing, it was natural that Lloyd S. Tenny, who had been the assistant bureau chief in charge of marketing activities, should be promoted to the position of Chief of the Bureau. Cooper, whose leave of absence from the University of Kentucky had been for only 1 year, returned there on June 10, 1926. In his first annual report as Chief, Tenny stressed the importance of marketing research, particularly cooperative marketing (*36*, 1926, pp. 2-3):

> Undoubtedly some of the most important problems of the bureau are in the field of marketing. Intensive research covering the physical and biological problems of production has been carried on for many years by the department, but it is only recently that the economic problems of production and marketing have been given the attention they deserve . . .
>
> Perhaps the most outstanding work of the bureau in the field of marketing is in the field of cooperation. The work of the bureau in this field will be greatly enlarged during the current year in carrying out the provisions of the cooperative marketing act, approved July 2, 1926, which provides for the organization of a division of cooperative marketing . . . Through this division critical studies will be made of existing cooperatives to determine how they may function more effectively. Closer contacts will be maintained between the 12,000 cooperative organizations and this department. . . .

The emphasis given to marketing research and to marketing service and regulation also appears in the breakdown in the Bureau appropriations requested for fiscal year 1929. The amount asked for farm management and practice was $382,250, and it included the special item, cost of production. But $715,000 was requested for research in marketing and distribution. In addition, around $3 million was asked for marketing service and regulatory activities, of which the largest single item was $1,069,355 for the Market News Service.

For outlook work, designated a special project for the first time, $68,220 was requested. Earlier, the work had been divided between staff assigned to farm management and to marketing research. In discussing the need for listing outlook work as a special project in the appropriation act, Tenny stated that he felt the logical place for outlook work was in marketing rather than farm management. He was convinced that "efficient marketing begins with efficient production . . . we can do a great deal toward the solution of the marketing problem by the process of education and control of production . . ." (*31*, 1929, pp. 794, 815-879).

It is interesting to relate Tenny's statement emphasizing marketing as interconnected with production to Taylor's statement that marketing was as truly a part of production as the growing of crops. Former BAE Chief Taylor had said that "farm management involved the study of the markets as well as the study of the farm. . . ." (*32*, 1923, p. 57). Thus, with Tenny as leader, farm management and practice included work grouped under the following four headings for fiscal year 1928: (1) land economics, (2) rural life, (3) farm management and cost of production, and (4) farm finance, credit, and rural taxation.

In 1947, Tenny gave a paper on the early years of the Bureau of Agricultural Economics. Almost entirely, he emphasized marketing, especially the service and regulatory activities. After briefly discussing the origin of the Bureau, he stated: "It's far more interesting to discuss some of the problems that were before us in these early days. Naturally my comment will be mostly in the marketing field. It was this work that Dr. Taylor had asked me to handle." (*27*)

Tenny's inclination to focus on marketing service and regulation during his period as bureau chief coincided with Congressional interest in this work, an interest existing particularly because of the work's demonstrable and immediate results. He included as a part of marketing research the demand and price research, work that became increasingly important to the Congress as the farm depression deepened. But another closely related line of study on cost of production remained part of farm management research. The Congress continued to specify that $150,000 of the appropriation for farm management research could be spent for cost of production studies and it continued to ask for reports on this work.

The Federal Farm Board

On July 16, 1928, Tenny resigned from the Bureau to become vice president of Associated California Fruit Industries, Inc. Nils A. Olsen, Assistant BAE Chief since May 1925, succeeded him. Olsen had also served as Director of the Division of Agricultural Finance (*49*, pp. 11-13).

Olsen had assisted Henry C. Wallace in writing his book, *Our Debt and Duty to the Farmer,* endorsing the principles of the McNary-Haugen plan. President Coolidge, an active opponent, was to veto McNary-Haugen bills in 1927 and 1928. These bills proposed machinery for selling surpluses abroad at world prices and products for domestic consumption at a fair exchange value.

President Hoover, who would succeed Coolidge in 1928, more adamantly opposed the McNary-Haugen plan. As Secretary of Commerce in the Coolidge Administration, he had been influential in the selection of William M. Jardine for Secretary of Agriculture in 1925. While president of Kansas State College, Jardine had vigorously opposed the McNary-Haugen bills and he had expressed confidence in cooperative marketing as the solution to the farm problem.

Before he became Secretary, Jardine had testified that he did not think the Department of Agriculture was suited to advise on the problems of cooperative marketing. Nor did he change his position after becoming Secretary. The administration plan to counter the

McNary-Haugen proposal, known as the Jardine-Tichner plan, called for organization of an independent federal farm board. The board would loan funds to cooperatives on the theory that they needed more credit to attract members. Cooperatives could carry surpluses from one season to another, thus avoiding depressing prices (*16*, pp. 83, 107, 115-117, 159, 179, 187-188).

Olsen, as chief of the bureau, gave full support to Secretary Jardine. However, as assistant chief, Olsen had advised Jardine on April 24, 1926 that cooperatives could not handle farm surpluses because they did not control large enough amounts of commodities to affect prices sufficiently. He had predicted that unloading the surplus problem upon the cooperatives would destroy them. The creation of mushroom organizations through Government loans would not be likely to succeed. But as Bureau chief, Olsen supported the Federal Farm Board, established by the Agricultural Marketing Act of June 15, 1929.

In his 1929 report as chief to Secretary Arthur M. Hyde, who had succeeded Jardine on March 4, 1929, Olsen stated that the Federal Farm Board had been set up "as a new instrumentality to assist in solving the problems of American agriculture," to "translate into action the results of service and research." The Board policy was to rely on the Bureau of Agricultural Economics for comprehensive, reliable information on all economic phases of agriculture. The Bureau's fact-collecting and research activities had already been broadened in response to the requests of the Board. The Federal Farm Board financed establishment of outlook services in the Southern States and worked with the Department to develop a program for land use. The Division of Cooperative Marketing was transferred from the Bureau of Agricultural Economics to the Federal Farm Board on Oct. 1, 1929 (*36*, 1929, p. 1; *15,* No. 5200, Oct. 1, 1929).

The Federal Farm Board, interested in the possibilities of increasing foreign sales, specifically requested the Bureau to establish as soon as possible an adequate foreign agricultural service. The Board offered financial support for the work until a permanent provision for it could be made. In 1930, following the passage of the Foreign Service Act, the Division of Foreign Agricultural Service was established within the Bureau of Agricultural Economics. Eight years later, the division was transferred to the Office of the Secretary and in 1939 it became the Office of Foreign Agricultural Relations.

Olsen continued in his annual reports as BAE chief and in his testimony before Congressional committees to emphasize the value of the outlook service as a guide for farmers and the importance of cooperative marketing. Cooperation with the Federal Farm Board continued; the Bureau requested increases from the Congress to expand research on farm taxes, farm mortgage credit, price analyses, foreign competition and demand, livestock estimates, and land use. The appropriation request for 1932 submitted in November 1930 for crop and livestock estimates was $1,200,000; for marketing and distributing farm products, $900,000; and for farm management and practice, $480,760 (*31*, 1932, pp. 476-477, 492-493, 502-503).

Every year in his discussions of the agricultural situation, Olsen reported the critical problems facing farmers but he did not offer any new solutions. On January 5, 1932, in his requests for appropriations for fiscal year 1933, Olsen had to report that the Bureau's initial requests for funds had been decreased in the budget process as part of the Hoover Administration's drive for economy. Olsen stated that he recognized the difficult position the country was in because of the large deficit and that the Bureau had cooperated fully in 1931 by setting up and maintaining large reserves of funds from the appropriations. He insisted, however, that the Congress provide the full amount of the funds requested in the budget because of the unusual character of problems confronting agriculture. This was no time to sacrifice fundamental services for "If American agriculture ever needed them, it is now, and in the years to come."

Congressman Michael J. Hart of Michigan, who had been a farmer, asked Olsen if he thought it would be possible to have "some control by law, or some law by which you could regulate production?" Olsen replied that in his judgment "it was not possible." Regulating production was a different thing than indicating that in light of world competitive conditions, farmers "might better grow a little less cotton." Hart challenged Olsen on the usefulness of outlook; "The farmer is on the very brink of destruction today, not withstanding all that information." To Olsen's reply that the farmer's critical situation was not caused by the information, Hart stated: "I do not think the information has hurt him any because I do not think he knows anything about it. Furthermore, the farmer does not need to be told that there is overproduction because he knows that anyway." Hart said that he did not think the outlook work was worth the money it cost (*31*, 1933, pp. 760, 763, 766-767, 787-790).

In December 2, 1932 testimony on the appropriation bill for fiscal year 1934, Olsen said he believed that Bureau activities were relevant to the economic crisis. "They are directed at that, but, in the second place, a great many of these services are aimed at preventing such as we have at the present time from occurring." He spoke of the Bureau's objective to build up "a continuing economic service which will keep before the farmers and the nation, the trend of developments in various directions, and on the basis of those facts be in a position to throw out lively warnings."

In his testimony, Olsen referred to a Senate resolution calling upon the Bureau to investigate how various plans for farm relief would work to raise hog prices. This, he stated, was the first resolution of Congress asking the Bureau to analyze a problem. Olsen said he was delighted to have the BAE render such a service, that he was willing to discuss a number of approaches to solving the depression in agriculture. These included: (1) bol-

stering prices by artificial means through credit or currency adjustments, (2) restoring markets and the purchasing power of consumers through reviving industrial activity, (3) increasing agricultural exports through large credits, accepting goods in return, or accepting gold in payments, and (4) increasing efficiency in production and marketing of products.

Congressman James P. Buchanan asked Olsen how the factories were going to put people to work. The BAE chief replied he was not ready to answer the question but that further adjustments in the cost of manufacturing might have to be made and that confidence needed to be shown by the banking institutions and by industry. It was, he said, fundamental that an improvement be brought about in the domestic and foreign markets for agricultural commodities. Congressman Hart of Michigan said, "That is one thing you and I agree on." Olsen retorted:

> Before we are through, we are going to agree on 99 percent of the things we are doing over in that bureau. The trouble with you is that you have not been over there to see what we are doing. We can help you and your group more than you think, if you will only come over there and let us do it (*31*, 1934, pp. 753-783).

Changes During New Deal Years

Henry A. Wallace became Secretary of Agriculture in 1933. He retained Nils Olsen as chief of the Bureau, as Wallace was not interested in replacing civil servants with political appointees. In addition, the new Secretary was influenced by the fact that Olsen had worked for and had been a friend of his father, Henry C. Wallace, when he was President Harding's Secretary of Agriculture.

But Olsen was not in sympathy with the New Deal programs. In 1935, without dissent from the Secretary, Olsen resigned and went to work for an insurance company. Wallace had felt the need to have a Bureau chief who was enthusiastic about the new programs, particularly the Agricultural Adjustment Administration (AAA). Thus, he selected Albert G. Black, head of the AAA's Livestock and Feed Grains Division and former head of Iowa State College's Agricultural Economics Department (*22*, 370-371; *20*, pp. 77-78).

A new division of marketing research was established in the BAE in January 1935 to study problems of distribution and consumption, to focus on spreads between the farm price and the retail price, particularly as they were affected by New Deal farm programs. The annual report of the Bureau for 1935 pointed out that price spreads in foreign countries were frequently narrower than in the United States. Projects of the new Division included intensive studies of selected marketing agreements and of the effects of commodity processing taxes on consumers and farmers. These studies were made in response to requests from the Agricultural Adjustment Administration. Bureau economists also undertook a series of studies to analyze the relationship between the prices paid to farmers and the prices paid by consumers for about 50 agricultural products. This type of research proved particularly popular in the Congress (*36*, 1935, pp. 23, 24).

Albert G. Black gave enthusiastic support to all the New Deal programs and complete personal loyalty to the Secretary. In his first annual report as chief of the Bureau, Black discussed at some length the coordination of the work of the Bureau with that of the Agricultural Adjustment Administration:

> The adjustment program has relied to a considerable degree upon the data and analyses prepared by Bureau workers who have been trained through several years of experience in assembling and interpreting statistical data with reference to various commodities and preparing outlook reports.

Black took the position that Government economists should contribute directly to agricultural programs and policy. They must not be content only to correctly analyze a problem and propose a solution. He believed that an economist who makes the correct analysis and cannot sell it convincingly has done only half the job and should be fired for not completing the work. Further, Black stressed the importance of theorists and generalists:

> Somewhere in the background but not too remote from current events there should be a group of economists who can devote their attention to a continuing development of theory. . . . This background of theory must be at any time the 'base line' from which those working in agricultural policy or upon programs or administrative problems must operate.
>
> There is needed too a large number of well trained economists who can view policy and program problems in their entirety. The highly specialized technician cannot produce the most effective results in the policy field. The most sought for advice is from the man who is competent to judge the validity of the studies of the technician but who has sufficiently broad training to synthesize correctly these results and to relate them to findings entirely outside the field of agricultural economics. There is great need for men who have this ability for synthesis (*8*, p. 310; *36*, 1935, p. 1; *20*, p. 78).

Secretary Wallace, Under Secretary Wilson, and their assistants shared Black's feelings about the role of Government economists. A close working relationship grew between the Secretary's office and the Bureau of Agricultural Economics. Then, because of circumstances outside the BAE, Black was asked to transfer from BAE, first to the newly created position of Director of Marketing and later to the job of Administrator of the Farm Credit Administration. In October 1938, he was succeeded as chief of the Bureau by Howard R. Tolley (*42*; *5*, pp. 246-250; *13*, Mordecai Ezekiel, M. L. Wilson, Louis Bean; *47*; *40*, No. 782, Oct. 6, 1938 and No. 783, Oct. 6, 1938).

Howard R. Tolley had previously worked in the Bureau of Agricultural Economics as head of the Division

of Farm Management and Costs (June 7, 1922 to June 15, 1924; July 17, 1926 to September 15, 1928) and as assistant chief (September 16, 1928 to March 31, 1930). He had left in 1930 to become director of the Gianinni Foundation at Berkeley, California, after becoming disillusioned with what he considered uninspired leadership in the Bureau and the Department.

In June 1933, Tolley had been called to Washington to develop a program for fruits and vegetables for the Agricultural Adjustment Administration. He became Assistant Administrator and director of the Program Planning Division, first called the Division of Planning, in December 1933. As division director, he had a major part in developing changes in the program of the Agricultural Adjustment Administration and in drafting the Soil Conservation and Domestic Allotment Act that was enacted by the Congress after the Supreme Court invalidated the Agricultural Adjustment Act. Tolley became AAA Administrator in June 1936.

Tolley's experience in the BAE and in the Program Planning Division of the AAA equipped him to head the BAE as reconstituted in October 1938 as the general planning agency of the Department. This change had come about through a need to reduce the size and power of the AAA in relation to other agencies and the Office of the Secretary, and as a part of a general USDA reorganization. All "action administration was to be grouped around a single core of program planning." Responsibility for the marketing and regulatory work of the Bureau was transferred to other Department agencies. This work included the Market News Service and responsibility for regulatory legislation which had grown out of earlier research programs of the Bureau. Among such programs were warehousing, establishment of standards and grades, produce marketing, and trading in cotton futures.

The selection of Tolley for chief of the newly reconstituted Bureau did not entirely result from his demonstrated ability in economic research and program planning. He was also chosen because AAA's field office had criticized him and because the Secretary's office was dissatisfied with his performance as administrator of the Department's largest, most controversial action agency (*38*, No. 1539, Mar. 11, 1936; *40*, No. 782, Oct. 6, 1938; *13*, Howard R. Tolley, M. L. Wilson, Paul H. Appleby; *20*, pp. 158-163).

Reorganization for Planning

In his first report as chief, Tolley called fiscal 1939 the reorganization year for the BAE. He wrote that the period

> witnessed transformation of the Bureau from an agency dealing in economic analyses and performing a multitude of statistical, service, and regulatory duties into an agency functioning with a Department-wide scope both as a clearing house for agricultural planning in the Nation and as an economic-research organization.

As reorganized, the Bureau had three essentially different functions or methods of attack:

- Continuation of the fundamental research program
- Collaboration with the Federal and State extension services and the State agricultural colleges "to the end that farmers themselves will participate in the development of plans and suggestions for agricultural programs"
- Assumption of "the responsibility for developing, in close cooperation with other bureaus and agencies in the Department, an integrated and continuing national agricultural program."

The third mission, Tolley suggested, involved the observation of the several action programs in the field and an "honest appraisal of both their shortcomings and their accomplishments." Tolley called the second and third functions essentially new efforts for the Bureau.

To assist the BAE chief, key men, called coordinators and later integrators, were selected to be in charge of six major groups of activities: (1) general planning; (2) rural welfare; (3) conservation and land use adjustment; (4) market planning; (5) agricultural outlook; and (6) program relations. The coordinators were members of the interbureau coordinating committee to which all plans, technical suggestions, and administrative proposals were sent. The proposals were to serve as the basis for the chief's recommendations to the Secretary's Agricultural Program Board. The heads of other Department bureaus served as members of the coordinating committee. Tolley chaired the committee and served as a member of the Agricultural Program Board. The committee operated through numerous subcommittees assigned to work on the solution of particular problems and terminated when they completed the work.

In 1939, the Bureau had 12 divisions: agricultural finance, economic information, farm management and costs, farm population and rural welfare, land economics, statistical and historical research, State and local planning, program surveys, marketing and transportation research, program study and discussion, program development and coordination, marketing programs and coordination. The Division of State and Local Planning had been established early in 1939 to continue some studies begun in the Program Planning Division of the Agricultural Adjustment Administration. The Bureau's Marketing Research and Marketing Transportation Divisions were merged on May 19, 1939, into the Marketing and Transportation Research Division. The Division of Agricultural Statistics was transferred to the Agricultural Marketing Administration on July 7, 1939.

In the 1940 annual report, Tolley called the Bureau of Agricultural Economics "the medium through which the separate units of the Department plan the activities of the total Department of Agriculture. It is also the focus of the Department's social and economic research." The twin activities, he wrote, merge into a single endeavor. At the outbreak of war in Europe, the BAE's program was adapted to provide special reports of the war's probable effect on prices, supply, and production. However, the Bureau's ultimate goals remained unchanged (*36*, 1940, pp. 1-2).

Adjusting to the War Years

On September 5, 1940, Claude R. Wickard succeeded Henry A. Wallace as Secretary of Agriculture. Unlike the two Wallaces, Wickard in his training and background had not developed faith in the ability of agricultural economists to help formulate agricultural policy. He had been a successful Indiana farmer and had served a term in the Indiana State Legislature before coming to Washington as Assistant Director of the North Central Division of the Agricultural Adjustment Administration. Wickard had moved up to become director of this Division, and on March 1, 1940 he became Under Secretary. His chief interest was in the agricultural adjustment program and he selected as immediate staff members people with whom he had worked in the Agricultural Adjustment Administration (*9*; *2*, pp. 251-252, 291-292; *5*, p. 273; *38*, No. 1401, Feb. 2, 1940).

The problem of determining the Department of Agriculture's role in the national defense program confronted Wickard when he assumed office. In this area, competition soon developed between the BAE and the AAA. Tolley had been making plans for the adjustment of Department programs to defense needs. The extent of adjustment required, and the types of field organization needed, soon became a point of controversy. At the same time, Wickard had to face challenges to his authority from members of the National Defense Advisory Commission. The Agricultural Commissioner posed a threat in relation to the possible development of an independent food administration. The Price Commissioner wanted to establish an Office of Price Administration.

In Tolley's plans, the State and county planning committees would serve as the field organization of the Department for defense and war activities. Feeling that the committees were in a strategic position to coordinate agricultural programs in the field, he recommended that these committees give defense planning a high priority. AAA Administrator Evans and others in the agency protested that the State and county planning committees had not been involved in practical programs of interest to the AAA. Instead, its farmer committees should be given responsibility for any special defense activities.

On July 5, 1941, Secretary Wickard established new State and county defense boards to coordinate the defense activities. The chairmen of the AAA farmer committees were to chair these new boards, and the State chairmen were to report directly to the Secretary. This decision offered only one of the indications that Wickard would not give strong support to the Bureau of Agricultural Economics in its role of general planner for the Department.

However, Secretary Wickard was willing to make the Bureau responsible for production goals, and he called on it to establish an Interbureau Production Goals Committee. Also, on May 31, 1941, he asked the Bureau to establish an Interbureau Coordinating Committee on post-defense programs (*9*; *20*, pp. 202-207, 214-215; *40*, No. 921, July 5, 1941, No. 913, May 31, 1941).

But on December 13, 1941, Wickard further diminished the Bureau's planning role. He abolished the Agricultural Program Board, which had been established to review, evaluate, and make recommendations to the Secretary on the BAE's plans and programs. He replaced this board with the Agricultural Defense Board, to which the BAE chief belonged, along with other agency heads, as an ex officio member. The Secretary's 1941 memorandum also transferred the Division of Agricultural Statistics back to the Bureau of Agricultural Economics from the Agricultural Marketing Service.

Tolley's relationship to Wickard, which had never been close, became increasingly strained. On Feb. 25, 1942, the Secretary's office selected O. V. Wells to serve as a member of a three-man price committee designated to advise the Secretary on proposed price control actions. Wells became, in practice, the Department's liaison representative at the staff level with the Office of Price Administration. Such an appointment would previously have been given to the chief of the BAE and Wells would have served as an alternate. Tolley, feeling he could contribute more to the Department's war role within the Office of Price Administration, split his time between its Food Price Division and the Bureau from March to June of 1942 (*40*, No. 960, Dec. 13, 1941, No. 985, Feb. 25, 1942; *2*, pp. 252-291).

Early in 1943, a separate War Food Administration was established in the Department but its Administrator reported directly to the President. The BAE handled economic staff work for both the War Food Administrator and the Secretary, and BAE data and analyses proved indispensable to wartime food and production programs.

While the Bureau's influence on policy and programs was declining, it was also being attacked by the American Farm Bureau Federation. The Federation, conscious of its origin in the Extension Service, feared the emergence of a rival farm organization as an outgrowth of the State and county planning organization. The Federation proposed the establishment of a nonpartisan Washington board representative of the Nation's agriculture to administer some of the Department's programs and to carry out the BAE's planning activities. State committees would administer the Bureau's state-wide planning program. The Washington board would appoint committee members from nominees made by State Extension Directors after consultation with farm organizations.

Although the Congress did not accept the organization proposed by the Farm Bureau Federation, it did cut the BAE appropriation for fiscal year 1942 by $500,000. The following year, Congress prohibited the use of funds appropriated for fiscal year 1943 for State and county land use planning. This action had been recommended by the American Farm Bureau Federation to return the Bureau to its former status as a research and fact-finding agency.

These actions bitterly disappointed Tolley and others in the Bureau who had faith in the possibility of building a viable two-way planning process from Washington to the county and community and back to Washington.

Tolley attempted to save some of the planning process by drafting a letter for Secretary Wickard to send to the State Extension Directors. It would state that the Department believed in the basic objectives of the work and hoped that the States would be able to carry on without financial support from the Department. Tolley's draft also suggested that conditions might change after the war so that the Department could give assistance. Wickard did not send the letter. However, Bushrod Allin, in charge of the Agricultural Planning Field Service which had replaced the Division of State and County Planning on February 26, 1942, wrote to Bureau personnel in the field. He expressed confidence that the "democratic process would continue" in many States, and eventually rise to a new high. The work of the Service was discontinued on July 1, 1942, in compliance with the appropriation act for fiscal year 1943 (*18*; *10*, pp. 85-89; *31*; *42*, pp. 416-418; *20*, pp. 215-217; *31*; *44*, p. 168).

With State and county land use planning prohibited, the Bureau focused its efforts on contributions to wartime and postwar planning. Agencies and Departments throughout the Government used BAE research and statistics as a background for planning and program development concerning agriculture. An outstanding example was a major USDA project under the leadership of Sherman Johnson involving agriculture's capacity to produce.

The BAE Under Fire

During the war years, the Bureau worked to devise a uniform, integrated system for making sampling surveys needed by the Department and other Government agencies. This system, called the Master Sample, included social as well as economic information. When completed, the Sample was to provide three nationwide samples of farms, each including approximately 100,000 farms and representing every agricultural county. Because the Sample involved information on social as well as economic conditions, it would soon come under fire. Attacks on research conducted for the Master Sample and on the Bureau's postwar plans for the cotton program in the South would bring an end to the Bureau's planning role in the 1940's and to Tolley's career in the Department.

"A Conversion Program for the Cotton South" proposed that cotton prices be allowed to drop to a level at which American cotton could compete with cotton in world markets and with synthetics in the United States. Government payments would be used first to pay farmers the differences between prices received in the market and parity prices. Later, these payments would be made to encourage farmers to convert to other crops and to seek other means of livelihood. Through this method and other inducements, the Government would attempt to restrict cotton production to the lands best suited for it and eventually to reduce the number of people and the amount of land involved in farming in the South. Heavy emphasis would be placed upon industrialization of the South and upon training programs for people who would leave agriculture.

Tolley encouraged wide and critical discussion of the conversion plan. Wickard discussed it in a general way in 1944 and 1945 before the House committees on agriculture, and the Bureau provided fuller explanations. The plan also came to the attention of Southern newspaper editors and college officials.

The plan aroused much controversy. Some economists praised it as did the National Farmers Union. The American Farm Bureau Federation condemned the plan. As the controversy increased, the leadership in the Department of Agriculture changed. Wickard stepped down as Secretary to head the Rural Electrification Administration. He was succeeded by Clinton P. Anderson (*20*, pp. 227-234; *36*, 1943, 1944; *35*; *30*, pp. 94-102).

Anderson, a congressman from New Mexico, had made his reputation as chairman of the House Special Committee to Investigate Food Shortages. It was natural that Harry Truman, who became President after the death of Franklin D. Roosevelt in April 1945, would, after many years of service in the Congress, select a congressman to become Secretary of Agriculture. With Anderson's appointment, Truman returned the functions of the War Food Administration to the Department. When a part of the Department, it had, as was noted earlier, been under a War Food Administrator who did not report to the Secretary. The situation seemed to call for a reorganization of USDA and Anderson turned to Milton Eisenhower to chair a committee of consultants who were to draft reorganization plans. Eisenhower, then President of Kansas State College, had worked previously in the Department under three Secretaries—Jardine, Hyde, and Henry A. Wallace (*15*, No. 9577, June 29, 1945; *23*, pp. 8-10; *40*, No. 1106, July 3, 1945; *40*, Unnumbered, to Members of Dept. Agr., Aug. 18, 1945).

Howard R. Tolley and O. V. Wells were among those called by the Eisenhower Committee to discuss the proper functions of the Bureau. When asked whether the planning function injured BAE prestige as a research and analysis agency, Wells replied that the research function and the prestige of the Bureau suffered when its recommendations went contrary to those advocated by pressure groups. Wells said he believed that an overall planning agency could not exist successfully unless it was headed by the Secretary of Agriculture. The Bureau, he stated, considered its fundamental jobs to be (1) to supply facts and figures, and (2) to contribute as a neutral administrative agency to such planning as was done in the Department.

In his appearance before the Eisenhower Committee, Tolley described the work of the Bureau as being in four categories: (1) statistics; (2) economic research; (3) program analysis; (4) planning. When Eisenhower said that some people felt the Bureau was being injured by the planning function, Tolley mentioned the possible desirability of having a Bureau member serve as secretary on a proposed program planning board for the Department.

In the fall of 1945, the Eisenhower Committee recommended that the planning function be moved from the Bureau to the Office of the Secretary. When drafts of the Secretary's memorandum described before were cir-

culated, Tolley thought it would, in effect, reconstitute the Bureau as it had been in the days of Olsen, chief from 1928 to 1935 (*14*).

Secretary's Memorandum No. 1139 issued on December 12, 1945, stated: "Responsibility for leadership in general agricultural program planning, including direction of the interbureau committees and working groups both in Washington and in the field is hereby transferred to the Office of the Secretary." The memorandum also announced transfer to the Extension Service of BAE responsibility for public study and discussion of broad agricultural problems and policies.

The Bureau would be the Department's primary agency for collection and dissemination of agricultural statistics and for economic research and dissemination of the results. As a staff agency of the Secretary, the Bureau was to coordinate the statistical work and the economic research of the Department. The Secretary's memorandum spelled out the number of assistant chiefs and divided among them the following areas of responsibility: (1) collection of statistics on crops, livestock, prices and income, and research on sampling and statistical gathering and evaluating techniques; (2) research on economic production; (3) research on income distribution; and (4) program analysis and service, and farm population and rural life. An associate chief would coordinate and improve all statistical services and economic research in the Department.

The memorandum also established the Situation and Outlook Board in the Bureau to provide the technical review and approval of all economic situation and outlook reports prepared within the Bureau or other Department agencies.

What explains these restrictions on the functions of the Bureau and the rearrangement of its internal organization? The changes came primarily because of the severe attacks on the Bureau and its leadership by the American Farm Bureau Federation and by members of the Congress. The Bureau's conversion plan for the South not only aroused a storm of criticism but it proved to be personally embarrassing to Secretary Anderson. On November 12, 1945, addressing a meeting of farm officials in Memphis, Tennessee, he warned of the dangers of high cotton prices. "The cost of production must come down if we expect to compete with other nations in the world market or if cotton expects to compete at home against the synthetics." When criticized for the address by Southern congressmen, Anderson quickly disavowed this speech and others on the subject which had been drafted within the Bureau of Agricultural Economics, leaving Tolley to absorb the bitter attacks. Senator Bankhead called the cotton conversion plan a waste of Government money and he suggested that Tolley wanted to remove owners of good Delta land so that Negroes could be placed there. Bankhead commented that the Congress thought it had stopped this type of change when it had prohibited funds for State and local planning.

Congressional anger also focused on a sociological study made in Coahoma County in Mississippi, conducted in connection with the Master Sample Project. The study, entitled "Cultural Reconnaissance," contained references to race relations, white supremacy, and racial segregation. The report, marked "For Administrative Use," was to have been summarized and used as part of a nationwide study. The Director of the Mississippi State Extension Service obtained a copy of the study and called Secretary Anderson's attention to it, labeling it nothing but lies. Immediately after learning of the Coahoma County report, Anderson announced his decision to limit the functions of the Bureau.

But the changes made by Anderson's December 12 memorandum did not satisfy the American Farm Bureau Federation and the critics in the Congress. They demanded more severe restrictions. The Federation recommended to the House Subcommittee on Appropriations for the Department on February 6, 1946, that the Bureau be "prohibited from conducting social surveys, agricultural planning and promotion, and opinion polls except bona fide factual marketing studies and surveys of consumer attitudes and preferences with respect to the consumption of agricultural commodities." The Farm Bureau further recommended that no funds for this type of work be provided and that the regional offices be eliminated.

Congressmen Thomas G. Abernethy and Jamie L. Whitten of Mississippi charged that the Coahoma County study was one the Bureau had no right to make. According to Whitten, the study "slandered a fine people" and he suggested that the farmers might benefit if Bureau functions were limited to agricultural statistics. He threatened the Bureau with legislation to prevent it from making "vicious attacks" on a county and its people. Congressman Malcolm C. Tarver, chairman of the subcommittee on appropriations, insisted that treatment of Negroes was probably better in Coahoma County than in some industrial sections of the North. He stated that the Bureau must not be allowed to engage in any similar studies.

Critics focused their anger on Tolley as Bureau chief because he furnished statistics to the Office of Price Administration for price control purposes and he did not take a stand against imposition of a price ceiling on raw cotton. When Tolley said he had not been consulted on the proposed price ceiling, Tarver suggested that Tolley's duty as the Secretary's adviser on economics was to advise the Secretary whether it was requested or not. Asking what Tolley's advice would have been under the circumstances, Tarver said he had a right to raise the question because he needed to know just how much good Tolley was doing for the farmer:

> I want to know whether you are working for the farmer or not, and whether you are active and alive in his behalf; whether you are fighting for him, or whether you are more interested in either looking after the consumer or in maintaining the salary levels of the organization which you represent.

In discussing the Bureau's role, Tolley called the Bureau of Agricultural Economics a statistical and economic

research agency. The Bureau. he stressed, was limited to making studies and carrying on economic research involving an analysis of the probable results of alternative lines of action. He explained that a distinction existed between a conclusion reached from an economic analysis and a recommendation as to what should be done. The Bureau gave advice when requested and furnished facts. It no longer had responsibility for leadership in general agricultural program planning.

But members of the subcommittee on appropriations did not recognize the distinction made by Tolley and continued to criticize him (*38*, Nos. 2082-5, Nov. 12, 1945; *31*, 1947, pp. 33-36, 184-203; *20*, pp. 231-234; *40,* No. 1139, Dec. 12, 1945; *23*, pp. 69-70, 133).

Before final Congressional action on the appropriation bill, Tolley resigned as chief of the Bureau. On May 14, 1946, Tolley told his staff that his main reason for leaving was his belief that his services would probably be more valuable in the Food and Agriculture Organization (FAO) than anywhere else during the next 4 years. He had accepted a position as chief economist and director of the Division of Economics and Marketing in FAO, an organization he had helped to establish. Congressman Whitten of Mississippi later stated that the appropriations subcommittee had been responsible for Tolley's departure from the Bureau (*29*).

Secretary Anderson chose Oris V. Wells to succeed Tolley. Wells, a career employee of the Department, had been associated with Tolley in the Program Planning Division of the Agricultural Adjustment Administration and in the Bureau of Agricultural Economics. Wells did not object to the limitations placed upon the Bureau by Secretary Anderson and the Congress.

On March 20, 1947, Wells reported to the House Subcommittee on Appropriations for the Department that the BAE's Division of Program Study and Discussion, the Division of Program Analysis and Development, and the eight regional offices with the jobs of the regional analysts had been discontinued. In addition, the Division of Program Surveys had been abolished and most of its functions transferred to a new division of special surveys, later renamed consumer surveys.

The number of research workers, full-time basis, Wells stated, had been reduced by about 100. But the number of statistical personnel, full-time basis, had been increased by about 80, or around 13.5 percent compared with fiscal year 1946, indicating an emphasis on statistics and a down-grading of research. The actual count of full-time employees in the Bureau had dropped to 1,226 as of December 31, 1946, compared with 1,386 on December 31, 1945. Total employees in the Bureau or agencies which had consolidated with it as of December 31, 1940 numbered 2,093.

In reorganizing the work, Wells said that he had had four objectives: (1) to center attention on the Bureau's function as the central statistical and economic research agency of the Department; (2) to simplify the general administrative structure of the Bureau; (3) to strengthen cooperative relationships with State colleges and State departments of agriculture as well as with other bureaus and agencies in the Department; and (4) to review the entire Bureau program to eliminate less essential activities and center work in the field where it was most needed.

Wells stated that he would like to put before the committee his own general philosophy with respect to the Bureau:

> I have looked on the Bureau of Agricultural Economics in the years that I have worked with it, and I still do, as a general service agency completely across the agricultural field. I feel that the Bureau of Agricultural Economics, and its companion bureaus, the Bureau of the Census and the Bureau of Labor Statistics, are the agencies which should be responsible for seeing that the administrative officials, the Congress, and the people are reasonably well informed across the entire economic field.

In explaining economic investigations, Wells said he felt that most of the work was designed to turn out statistics. These statistics, he said, required a more analytical approach and they had not become routine like the crop and livestock estimates. The number of economic studies had been reduced from 160 for fiscal year 1946 to 138 for fiscal year 1947, a further indication of a reorientation of BAE's work (*38,* No. 1096-46, May 14, 1946; *31*, 1948, pp. 350-377).

In January 1947, the Secretary's Office organized four overall policy committees on long-range planning to bring together plans of 17 subcommittees of the Program and Policy Committee. Wells took steps to ensure that the Bureau would not again be considered a policy agency. Since the chairmen of these four committees would be official spokesmen for the Department, he asked that no member of the BAE chair one of the overall committees. However, Wells agreed, at the Secretary's and Assistant Secretary's request, to serve as chairman of the Conservation Committee. This job, he said, would involve bringing together material prepared by other agencies. Each of the 17 subcommittees contained a BAE staff member, and these men supplied the data and made many of the calculations used by the four policy committees and the Secretary.

Congressman Everett Dirksen, chairman of the appropriations subcommittee, praised Wells during the 1949 appropriations hearings for the "vital job" he was doing. Congressman Whitten said "your Bureau has done an excellent job and should be commended—not only the Bureau but yourself" (*31*, 1949, pp. 362-363, 371-372).

On February 4, 1952, during testimony before the subcommittee, Wells again emphasized the technical and service aspects of the work classified as economic investigations. Only about 50 percent of the funds under this subappropriation were, he reported, used for "what we would ordinarily think of as research, and this includes a considerable amount of service research in connection with our outlook and situation work. . . ." He labeled the project on agriculture's capacity to produce as semiservice (*31*, 1953, p. 180).

Wells also reported further curtailment in economic investigations. Funds available for fiscal year 1953 would be reduced 15 percent from the level in fiscal year 1952, and the number and volume of commodity and situation reports had been cut about 20 percent.

Charles F. Brannan had succeeded Clinton P. Anderson as Secretary on June 2, 1948. Secretary Anderson returned to the Congress to serve as Senator from New Mexico. Secretary Brannan retained O. V. Wells as chief of the BAE and allowed him free rein in administering it. At Brannan's request, Wells organized and chaired a seminar on national agricultural policy. Its objectives were to sound out Departmental thinking and to discuss current facts, trends, and problems involved in determining agricultural policy. Five of the twenty USDA officials who attended regularly were economists. Two were members of Wells' staff.

The plan which emerged from the meetings and from the Secretary's convictions became known as the Brannan plan. The Secretary told staff members they need not espouse the plan but should be able to explain it. Some of the five economists disagreed with important aspects of the plan, aspects which would have substituted an income standard formula for the parity formula and would have provided compensatory payments to producers of perishable crops when prices did not measure up to the standard. The new income standard would also have been used for basic crops supported by loans. The American Farm Bureau Federation and many members of Congress denounced the plan. Use of income payments received the most bitter opposition in the Congress. But such a scheme has been used for a number of crops since 1965 (*38*, No. 1148-48, Jan. 2, 1948; *11*, pp. 21-63; *32*, 1950, pp. 129-130).

Demise of the Bureau

Ezra Taft Benson became Secretary of Agriculture as of January 21, 1953. The first Secretary of Agriculture in a Republican Administration since Hyde served in Hoover's Cabinet, Benson had ideas on Government programs diametrically opposed to those of Brannan. Benson's plans for a major reorganization of the Department, announced on October 13, 1953, called for the abolition of the Bureau of Agricultural Economics, dividing its functions between two new agencies—an Agricultural Marketing Service and an Agricultural Research Service.

The plans were protested by a hastily organized committee of agricultural economists that included the Bureau's first chief, Henry C. Taylor; Howard R. Tolley, then with the Ford Foundation; and Raymond J. Penn of the University of Wisconsin. This committee offered a compromise plan after it became apparent that the Secretary would accept "no sweeping departures" from his plan no matter how strong the objections and that the "top men in the BAE had already accepted it . . . . " But the committee compromise was rejected, and after the reorganization had taken effect, the committee's views and the views of other economists appeared in an article entitled: "The Fragmentation of the BAE" (*45*). The economists' argument contained several points:

- The need existed for a strong program of fundamental, longer run research—as distinguished from operations and program research pointed at immediate improvement
- It was important that the research be carried on in a unit removed from action, service, and regulatory work to preserve its objectivity and freedom from pressures
- Farm management research should remain within agricultural economics and
- A type of organization like the BAE would give agricultural economics a high standing and it would attract people of first-rate ability.

Paul Appleby, who had been Henry A. Wallace's administrative assistant, also criticized the reorganization:

> It would seem fair to say that the Secretary of Agriculture will be more poorly served than he has been in the past whether he knows it or not. It may also be asserted with confidence that the Department of Agriculture has become a place much less attractive to first rate economists. These things are of concern not only to economists (*4*, p. 12).

"The Fragmentation of the BAE" began with a section by O. V. Wells defending the changes. He stated that three underlying principles had activated the Secretary's committee on reorganization:

- The decision to make lines of authority as clear as possible and to limit the number of people reporting at each level of authority within a reasonable working limit
- "The decision to organize the various Services or program agencies in such a way as to provide for a concerted or team attack on certain broad problem areas facing farmers and businesses handling farm products rather than particular commodities"
- "The decision to adopt a uniform nomenclature which not only starts with the use of the overall term 'Service' . . . for the larger aggregation but which also gives units and individuals performing similar functions the same descriptive titles, including the elimination of all the old bureau names" (*45*, pp. 2-3).

The reorganization, effective November 2, 1953, put the assistant chief for production economics, along with all work relating to farm management and costs, land economics, and agricultural finance in the Farm and Land Management Division of the Agricultural Research Service; there, most of the work was organized in a production economics branch.

All marketing and transportation research was transferred to the Marketing Research Division of the Agricultural Marketing Service (AMS). The assistant chief for prices and income, along with statistical and historical research work on farm population and rural welfare, was transferred to the AMS Agricultural Economics Division. The assistant chief for agricultural estimates, along with the entire crop and livestock estimates staff, went to the AMS Agricultural Estimates Division.

Wells stated that he felt the reorganization offered agricultural economists more opportunity for research and program assistance within the Department than they would get in any other form of organization advanced in recent years. Agricultural economists and statisticians, he said, had responsible roles within the Agricultural Research Service, the Agricultural Marketing Service, and the Farmer Cooperative Service (FCS), which had been a part of the Farm Credit Administration. FCS remained in the Department when the Farm Credit Administration became an independent agency on December 5, 1953.

To his own staff, Wells advanced the theory that economic research would fare better in a big operating agency where it would not have to fend for itself in the budget process. On November 2, 1953, he became Administrator of AMS as part of the reorganization (*7*; *40*, No. 1320, Supp. 4, Nov. 2, 1953; *45*).

The theory seemed to be borne out that it would be easier to obtain appropriations for research when it was part of an action agency than when it stood alone. However, part of the ease with which Wells secured increased appropriations for research came from his good relationships with Congressional committees. The amount spent on marketing research increased from $4,303,736 in 1952 to around $7 million in 1958. The appropriations for economic and statistical analyses increased from $866,000 to more than $1½ million in 1958.

But appropriations were not increased without questions and criticisms concerning the expansion of research in certain areas. For example, in 1955, Congressman Whitten stated that research was so popular with the committee, the public, and the press, that sometimes "we let a lot of farfetched things get into the picture in the name of research." He seriously questioned the research project on the levels of living for low-income groups, stating that it was not the kind of research most people had in mind when they wrote letters asking for more research. He doubted whether the Congress wanted such research when it made the appropriation. Whitten also questioned whether money should be spent for studies on agricultural labor relations (*31*, 1956, p. 1025).

Wells' inclination to limit research involving social and psychological problems and his personal popularity kept him from having serious problems with the Congress. But the Administration changed in 1961 and Orville Freeman came to the Department with restoration of the Bureau of Agricultural Economics as one of his major objectives. Wells could have remained as head of AMS. But, like Tolley before him, Wells left the Department for the Food and Agriculture Organization.

THE ECONOMIC RESEARCH SERVICE

On April 3, 1961, economic research within the Department was concentrated in the Economic Research Service (ERS) created by Secretary's Memorandum 1446, Supplement 1. In establishing ERS and another new agency, the Statistical Reporting Service, both under a Director of Agricultural Economics, Secretary Freeman said:

> They will put renewed vigor into providing better information to U.S. farmers, ranchers and consumers and to foreign countries on agricultural needs both in the United States and abroad. This also will help the Department develop a food budget that will give hard figures on normal needs of food and fiber for our own people, supplemental needs for distribution to the needy, and overseas needs in terms of our foreign economic program (*38*, No. 1019-61, Apr. 3, 1961).

Nathan M. Koffsky was chosen to head the Economic Research Service. A career civil servant, he had worked in the BAE from 1934 to its abolition and then he had transferred to the Agricultural Marketing Service. There he had been deputy administrator for economics and statistics; prior to that, Koffsky had worked mostly in the farm income field (*38*, No. 1019-61, Apr. 3, 1961).

The new Economic Research Service differed from the Bureau of Agricultural Economics in two vital respects. First, it reported to the Director of Agricultural Economics rather than to the Secretary of Agriculture. Second, the collection of crop and livestock estimates became the responsibility of the Statistical Reporting Service. In addition, a Staff Economists Group was established which, in the words of the first Director of Agricultural Economics:

> assists the Director in the development of short- and long-range economic research and statistical work required by the Secretary of Agriculture, undertakes analytical studies of current and proposed agricultural programs, and represents the Director in the economic and statistical review of program actions.

Thus, the ERS administrator, unlike such early BAE leaders as Henry C. Taylor, Howard R. Tolley, and O. V. Wells, stood two steps away from the Secretary of Agriculture. As for crop and livestock estimates, the administrator could ask that certain things be done. The BAE chief could have directed that they be done (*12*).

The Economic Research Service included work previously assigned to the Agricultural Marketing Service, Agricultural Research Service, and Foreign Agricultural Service. These activities were reorganized under a deputy administrator for agricultural economics and a deputy administrator for foreign agriculture.

Initial Work Areas

As first announced on April 4, 1961, the Deputy Administrator for Agricultural Economics was responsible for four divisions: economic analysis, marketing economics research, market development research, and production economics. The Deputy Administrator for Foreign Agriculture was charged with the agricultural regional analysis division and the development and trade analysis division. Within 2 months, the divisions reporting to the Deputy Administrator for Agricultural Economics had been reduced to three: economic and statistical analysis, farm economics, and marketing economics.

During his first year as administrator, Koffsky appointed a number of committees to consider problems involving more than one division. The major committees included: automatic data processing, agriculture and economic growth, economic projections, foreign economic development, and rural development research.

On December 4, 1962, the Resource Development Economics Division was established to conduct the economic research and service work related to "institutional and group activity in the use, development, conservation, and management of rural resources. This will include economic development, rural renewal, river basin and watershed programs, and resource policy." The new Division consisted of two branches from the Farm Economics Division, which was renamed the Farm Production Economics Division (*37*, No. 15, Dec. 4, 1962).

When the Economic Research Service was established, the only new task specifically assigned to it was the development of a "food budget." A formal plan and procedure for the "1962 World Agricultural Situation" was issued on September 18, 1961. A preliminary report was issued in March 1961, while "The World Food Budget, 1962-66" appeared in October. These documents were valuable both in supporting and giving direction to a policy decision which had already been made—to greatly increase the overseas shipments of American agricultural surpluses. The praise which the World Agricultural Situation received led to its regular issuance.

Since ERS was established after Congressional hearings had been held on 1962 appropriations, the administrator had almost a year in which to set up his formal organization and to determine and assign lines of work. Generally, however, the lines of work were those that were followed earlier. Koffsky stated that the economic research programs were "directed toward finding answers to current and emerging problems of agricultural production, marketing and distribution" (*31*, 1963, p. 1130).

The work was divided into three projects for accounting purposes: farm economics research, marketing economics research, and domestic and foreign economic analysis. Koffsky requested an increase of a million dollars over his 1962 budget of $9.4 million. The areas in which the increases were requested indicate, at least to a degree, his views of the comparative importance of the work.

Not surprisingly, considering Koffsky's previous work in the farm income field, the largest increase—$595,000—was requested for farm economics research. Of this sum, $190,000 would expand economic studies of rural development, $280,000 would strengthen economic research in land and water conservation and development, and $125,000 would increase research in farm size.

No change was proposed in the marketing area. The increase requested for domestic and foreign economic analysis was $435,000. Of this, $185,000 was in situation and outlook work and $250,000 was in the foreign area, including foreign markets.

None of these increases were recommended by the House Appropriations Committee while the Senate Committee recommended an increase of $500,000. As finally passed, the 1963 appropriation granted $90,000 more, for studies on the "economics of farm size and numbers and on domestic agricultural and outlook reporting" (*31*, 1963, pp. 1127-1195).

The greatly increased emphasis by the Federal Government on exports under P. L. 480 and the use of some of the P.L. 480 funds for market development and for economic development in the less developed countries offered new opportunities for ERS to demonstrate the value of its research. During the early and mid-1960's, a number of long-term ERS studies of supply and demand in foreign countries proved especially popular with U.S. exporters.

The Agency for International Development (AID) financed much of the research work by the two divisions concerned with foreign developments. In March 1963, the Foreign Development and Trade Division agreed with AID to undertake a major research project: "Factors Associated with Differences and Changes in Agricultural Production in Underdeveloped Countries." The ERS team organized to undertake the research produced its first major report, *Changes in Agriculture in 26 Developing Nations*, late in 1965. This report, a spectacular success, added greatly to the respect accorded ERS research in the international development field. Thus, the administrator could focus his requests to the appropriations committees on other areas, since much of the foreign research could be financed by transfer funds.

ERS requested an increase of $772,600, about half of it to cover increased pay costs, in the 1964 appropriation. Koffsky proposed other fund increases and shifts as follows: $209,800 for estimates of land requirements; $200,000 less in marketing economics; $125,000 for outlook and situation reports; $90,000 for farm income estimates; $93,300 for research on Common Market trade in farm products; and $110,000 for longer range prospects for foreign demand and trade in farm products. These proposals, taken as a whole, foreshadowed an increased emphasis on the general area of farm economics research, including farm production, rural development, and natural resource economics; and a decreased emphasis on marketing research.

The House Appropriations Committee recommended a net increase over 1963 of $320,850, most of this to help meet pay and postal increases. The only substantive increase was $110,000 for research on foreign trade expansion and the Common Market. The Senate Committee recommended an additional $133,700 over the House figure to cover the full amount of pay costs. In the final act, a total of $9,912,000 was appropriated—a compromise between the House and Senate versions (*31*, 1964, pp. 1089-1135; *32*, 1964, pp. 786-808).

Administrator Koffsky asked for an increase of only $229,200 for 1965, to cover mandatory pay increases, and the House Committee recommended this amount. However, the Senate Committee recommended an increase of $1,329,200 over 1964, including $500,000 for

economic research on pesticides and $600,000 for accelerated cost-of-production research on cotton. These additions were included in the final appropriation of $10,576,000. Subsequently, an appropriation to cover increased pay costs brought the total to $10,922,000 (*31*, 1965, pp. 205-260; *32*, 1965, pp. 352-374).

Obviously, the farm economic area, which included the work being done by the Farm Production Economics Division and the Natural Resource Economics Division, plus that to be done in the proposed Economic Development Division, was receiving most of the increases in appropriations. The marketing economics area was declining; price research, as related to support programs, had been important, but had become less so.

New Emphasis in the 1960's

The shift in focus to farm economics reflected the directions in which the President and the Secretary of Agriculture were looking in the 1960's. The goals of the "Great Society" included improvement in the physical environment and a concern for the poor. A disproportionate number of people who were sometimes called the "hard core" poor lived in rural areas. Thus, the Economic Research Service was called upon by the Director of Agricultural Economics, the Under Secretary, and the Secretary to provide background and backup economic material for programs to upgrade the rural environment, provide for rural development, and overcome poverty in rural America. Greatly expanded programs were developed, with the help of ERS studies and data, in all of these areas. However, President Johnson later decided to deemphasize such expensive programs until the United States won the war in Vietnam.

These new pressures caused by the war and Great Society programs led to a reevaluation of the place of basic research, priorities in research, and the field organization. Such rethinking, of course, is ongoing in management of a research program.

In a memorandum of February 19, 1964, Koffsky stated that it was ERS policy "to support a balanced program of fundamental and applied research." He set out a plan for giving some people in ERS special research assignments to concentrate on fundamental, basic, or pioneering research. But little came of this plan (*37*, No. 26, Feb. 19, 1964).

On June 10, 1965, Koffsky issued a memorandum on the field organization. One particularly interesting sentence read:

> The time is approaching when the staff of the Service must further concentrate its people and facilities to improve the quality of its research product, to reduce further the fragmentation of research effort both in Washington and in the field, and to more effectively mobilize our people, in concert with our cooperating agencies, for more effective research.

While awareness of the problem was evident, solving it was difficult. And though ERS management recognized the need to assign priorities to research, doing so proved hard.

In 1964, Director of Agricultural Economics Willard W. Cochrane resigned to return to the University of Minnesota. In reviewing his experiences, he pointed out that the Economic Research Service had no pressure group backing it and would always have problems in obtaining appropriations. Many Congressmen would oppose it unless its research results turned out "right." Administrators of the Department's large agencies would be anxious to carve up ERS to add parts of it to their empires. The staff work demanded of ERS—planning and appraising other people's programs—would often lead to difficulties. Without strong support from the Secretary of Agriculture, ERS would have a difficult time surviving (*38*, No. 1887-64, June 5, 1964).

Cochrane was succeeded in June 1964 by John A. Schnittker, who had headed the staff economists group in Cochrane's office (*38*, No. 1887-64, June 5, 1964). About a year later, Schnittker became Under Secretary of Agriculture (*38*, June 1, 1965). Nathan Koffsky succeeded him as Director of Agricultural Economics. In August 1965, M. L. Upchurch became administrator of ERS. Upchurch's long career with ERS—aside from service with the U.S. Army and 4 years of teaching at Oregon State University— had been mainly in the field and in the area of farm production economics (*38*, No. 2524, Aug. 13, 1965). Walter W. Wilcox became Director of Agricultural Economics in January 1967 and was succeeded by Don Paarlberg in January 1969.

On August 13, 1965, the Economic Development Division was created. Administrator Upchurch stated the new division had resulted from a conference held at Front Royal, Virginia, and from a report of a program evaluation committee. The major part of the new division came from the Resource Development Economics Division, renamed the Natural Resources Economics Division. The Development and Trade Analysis Division was renamed the Foreign Development and Trade Division to differentiate it from the Economic Development Division (*37*, No. 40, Aug. 13, 1965).

During Upchurch's service as administrator (he retired January 8, 1972), the trend towards emphasizing the work of the divisions grouped under the "farm economics" heading continued. As noted, this trend had started under Koffsky.

The tone for ERS appropriations had been set between 1962 and 1965; there would be little or no money for new research projects. From 1966 to 1972, the substantial increases almost entirely represented additional funds for pay raises voted by the Congress and signed by the President. Congressman Whitten said in 1967, quoting an earlier statement of his own: "'You insist on having a Bureau of Agricultural Economics. It is my judgment it costs you about a million or a million and a half dollars a year to carry that title, because it is hard to sell.' I still stick to that viewpoint" (*31*, 1968, p. 752). As evidence, only rarely did an appropriation increasing funds for a particular line of economic research get through

the Congress. Additionally, fewer people were employed by ERS in 1972 than in 1962.

As new projects developed within ERS, persons were shifted to them from previous lines of work. Practically speaking, such changes presented difficulties. The administrator, however, had some flexibility in appointments because funds could be transferred from other Department agencies. These fund transfers increased substantially in the last half of the 1960's, particularly in the foreign, natural resources, and economic development areas. Such funds provided 56 man-years of employment in 1965, 123 in 1968, and 80 in 1972. However, transfer funds could be, and at times were, cut off or decreased any year by the transferring agencies.

A problem that Koffsky had faced during his time as administrator—the relationships between basic research and problem-solving research—continued during Upchurch's administration of ERS. In testifying on the 1967 budget, Upchurch called ERS the economic intelligence arm of the Department—apparently the first use of this term in appropriations hearings. He said further:

> American farming and many aspects of the economic and social conditions of rural life are changing rapidly. Change requires adjustments so farmers, other rural people, their leaders, and policy-makers in executive and legislative branches of Government need the best and most complete information we can provide to make these adjustments most rationally.

The administrator listed eight areas that he considered most important for ERS research: fundamental structural changes in farming, changes in commercial farming, farm finances, income position of the family farmer, decline in use of farm labor, employment of land and water resources, rural welfare, and export markets (*31*, 1967, pp. 6-8, 33-51). In general, Upchurch continued to emphasize the problem-oriented approach. In testifying on the 1969 appropriations, for example, he said: "Our studies are designed to help farmers and other rural people with economic problems" *31*, 1969, p. 273).

But during the 1970 appropriation hearings, Upchurch expanded the ERS horizon:

> Our basic and continuing task is to provide the economic intelligence . . . that is necessary for understanding of the significance and meaning of changes taking place on farms, in related processing and marketing industries, and in rural communities, and to provide evaluations of the consequences of alternative courses of action in solving agricultural problems. In addition to this basic core of economic research we are being called upon increasingly by the public, the Congress and other agencies of the Federal Government for economic information related to very specific questions or to the solution of specific problems (*31*, 1970, pp. 604-605).

Here, he attempted in a limited way to distinguish basic economic research and information related to the solution of specific problems.

Over the years, however, the Congressional subcommittees on agricultural appropriations have seldom referred to the relationship of basic and problem-solving research. Indeed, they have assumed that all research was directed towards problem solving. The accumulation of "basic" data was regarded as useful if the material might be needed in connection with some specific problem.

When Upchurch left ERS at the beginning of 1972, the agency seemed to have three functions:

- Supply basic economic data
- Evaluate policy as required
- Provide prompt answers to pressing economic questions

ERS also had support from the Secretary of Agriculture and from other agencies inside and outside the Department. It was receiving substantial sums in transfer funds for particular jobs of economic analysis. As for the regular ERS budget, the Congress continued to be critical. The administrator sometimes seemed to be on a treadmill where great effort was required merely to remain in place.

Changes in the 1970's

The appointment of Quentin M. West as successor to M. L. Upchurch on January 9, 1972, led to the consolidation on February 6 of the Foreign Economic Development Service (FEDS) into the Economic Research Service as the Foreign Development Division (*40*, No. 1763, Supt. 1, Feb. 18, 1972). West, who in 1956 had joined the Foreign Research and Analysis Division, then part of the Foreign Agricultural Service, had become administrator of FEDS upon its establishment December 1, 1969 (*40*, No. 1668, Supl. 1, Nov. 26, 1969).

In his first appearance before the House Agriculture Subcommittee of the House of Representatives, West requested an additional appropriation of $1 million for fiscal year 1973. This sum included $400,000 for rural development; $400,000 for research to expand agricultural exports; and $200,000 for the economic analysis of programs relating to agriculture then being considered by the Environmental Protection Agency (*31*, 1973, Pt. 3, p. 698). Several Congressmen complimented West on his presentation. The agency received increases of $200,000 for research on foreign economic conditions, and $275,000 for the economics of predator control.

The next year, West proposed a reduction of $275,000 for cost/benefit analysis of predator controls, an increase of $100,000 to improve estimates of marketing margins, and an increase of $115,000 to improve estimates of farm income and related statistical series, for a net decrease of $60,000. Eventually, the Congress granted the increases requested, and it also appropriated $275,000 for predator control. Not less than $200,000 of the total appropriation was to be available for work on matters before the Environmental Protection Agency.

While presenting his proposed 1974 appropriation, Administrator West reported on a major ERS reorganization. Congressman Whitten questioned its necessity:

"You have the same crowd doing the same work, and you rearrange it and explain it on the chart telling us how much better it is, which indicates how bad it was. What was wrong with it before?" West replied: "I found it difficult to effectively manage with the existing organizational arrangement." He explained how he believed the new organization would be more flexible and efficient in adjusting workloads and shifting emphasis as priorities changed (*31*, 1974, Pt. 2, p. 71).

The reorganization became official on July 8, 1973. It had been in effect, for all practical purposes, several months before final approval, and the changes had been studied since early in 1972. West first had asked the division directors and other selected people to make proposals for reorganization. Second, he appointed an advisory committee, made up of representatives of ERS, other Department agencies, agribusiness organizations, agricultural universities, and other groups, to review the research programs of the divisions in the food and fiber sector. This committee and the ERS committees reported to the administrator in November 1972. The reports were considered in a broadly representative ERS conference on November 28-30 of that year. Attention focused on two major topics: the agency's mission and its organization.

On January 16, 1973, West proposed major changes in the Economic Research Service. He outlined the changes in detail in a memorandum to all ERS employees dated January 26, 1973. Work was divided into two major groups: food and fiber economics, and resource and development economics. The divisions of farm production economics, marketing economics, and economic and statistical analysis were abolished. Their branches were also generally broken up and reestablished as "groups," later "program areas," in two new divisions: commodity economics and national economic analysis. These, together with the Foreign Demand and Competition Division, made up the food and fiber economics group. The resource and development economics group included the community and human resources, natural resource economics, and foreign development divisions.

Administrator West stated that one objective of the reorganization was to do away with the field-Washington, D.C. distinction. The point was emphasized by the appointment of a few program area leaders to work outside Washington. While "divisions" were kept as organizational units, although with major changes in their composition, the former branches were replaced by "program areas."

During 1973, a number of other changes took place. The Economic Development Division was transferred to the Rural Development Service and back again (*40*, No. 1800, Feb. 12, 1973 and No. 1832, Dec. 4, 1973). There were serious proposals to transfer one or both of the divisions concerned with foreign agriculture to another agency, but the decision was made in the Office of the Secretary to keep them in the Economic Research Service. On April 28, 1973, market research functions were transferred to ERS from the Statistical Reporting Service to conform with guidelines from the Office of Management and Budget calling for a clear separation of research and data collection functions (*31*, 1975, p. 112). With the establishment of the Office of Communication in the Department on January 22, 1973, each agency was directed to set up its own information office (*40*, No. 1798, Jan. 22, 1973). The new Division of Information within ERS began functioning as such on July 8, 1973.

The reorganization coincided, in general, with an emphasis on "management by objective" throughout the Executive Branch of the Federal Government. In this concept, objectives would be set at the highest administrative levels, and persons and funds would be allocated in a manner to best meet these objectives. Management by objective was emphasized in the ERS reorganization. The major decisions would be made by the administrator and a planning staff, decisions at the next level would be made by the division director and a planning staff. The program areas would be adjusted as necessary; some people would be assigned to task forces or to a matrix group to complete particular assignments.

As one result, the administrator's and division directors' staffs were increased substantially. West believed this move was necessary for him to maintain control of programs and to attain ERS objectives by reallocating funds and personnel at frequent intervals.

By the end of 1974, the reorganization had given the administrator a control over economic research greater than that of any previous administrator. More research capacity was being directed toward solving economic problems facing the Nation in the agricultural sector, although some problems arose. The new structure, for example, did not fit neatly into the general civil service concepts of organization and troubles were experienced in establishing positions at desired levels. More important, as compared with earlier division organization, the separation of the commodity-oriented and aggregative program areas responsible for situation and outlook work into different divisions led to some "stickiness" in the exchange of information.

By 1974, West appeared to be overcoming some of the previous problems ERS had faced in securing appropriations. The Subcommittee of the Committee on Appropriations of the House of Representatives recommended substantial increases in the 1975 appropriations. The bill, when finally approved, provided increases of $75,000 for transportation research, $670,000 for cost of production studies, $385,000 for improving forecasting, and $275,000 for studying the impact of predators on Western livestock.

The Congress, in the Agriculture and Consumer Protection Act of 1973, assigned some definite responsibilities to the Department's economists. In the future, more so than in the past, levels of target prices and commodity loans would depend on economic estimates. In addition, the act required annual studies of the cost of production for wheat, feed grains, cotton, and other commodities.

The new organization received a severe test in 1972-

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1974, as farm prices and income and food costs rose sharply and production dropped. In the spring of 1973, the administrator appointed an ERS task force to review ERS forecasting procedures and recommend needed improvements. After preliminary discussions, responsibility for the study was assigned to Jim L. Matthews and Richard C. Haidacher. As part of their preliminary conclusions, they stated:

> While many deficiencies in the forecasting activity that existed prior to July 1, 1973 were helped significantly by the ERS reorganization, some still remain and some new ones have been created. The basic problem which still remains is an inadequate framework for global analyses . . . . In addition, the problem of coordination among program elements in the forecasting activity is greatly magnified (unpublished manuscript, Agricultural History files, ERS).

Before completion of the task force assignment, Karl A. Fox of Iowa State University appraised food price forecasting during 1973, on behalf of the Council of Economic Advisors. He saw the ERS reorganization as resulting in "major improvements, given time and resources" (unpublished manuscript, Agricultural History files, ERS).

Another task force, mainly ERS staff members, was established in 1974 to study methods of making situation reports more effective. Some of its recommendations became effective in 1975. Later in 1974, the administrator appointed a task force on farm income estimates, consisting mostly of economists from outside USDA and chaired by R. J. Hildreth of the Farm Foundation.

Such task forces, whether made up of members from inside or outside the organization, fit in with the tradition of the administration of economic research. They have served as a means of communication and as sources of recommendations for making ERS more effective.

There is no reason to believe that the administrative organization of economic research in the Department of Agriculture will remain static nor that shifts in emphases in research areas will not occur. Particularly changes seem likely since there seems to be no clear method of organizing economic research which is obviously superior to any other, just as no final answer exists to the economic problems of the American farmer. Administrative organization of economic research and areas of emphasis in that research will continue to alter to keep pace with a changing American agriculture.

Secretaries of Agriculture

Henry Cantwell Wallace, 1921-24
Howard Mason Gore, 1924-25
William Marion Jardine, 1925-29

Arthur Mastick Hyde, 1929-33
Henry Agard Wallace, 1933-40

Claude Raymond Wickard, 1940-45

Clinton Presba Anderson, 1945-48
Charles Franklin Brannan, 1948-53
Ezra Taft Benson, 1953-61

Orville Lothrop Freeman, 1961-69

Clifford Morris Hardin, 1969-71
Earl Lauer Butz, 1971-

Heads of Economic Research Agencies
(Bureau of Agricultural Economics, 1922-53;
Economic Research Service, (1961-)

Henry C. Taylor, 1922-25

Thomas P. Cooper, 1925-26
Lloyd S. Tenny, 1926-28
Nils A. Olsen, 1928-35
Albert G. Black, 1935-38
Howard R. Tolley, 1938-46

Oris V. Wells, 1946-53

Nathan M. Koffsky, 1961-65

Melvin L. Upchurch, 1965-72

Quentin M. West, 1972-

War Food Administrators

Chester C. Davis, 1943
Marvin Jones, 1943-45

Directors of Economic Research

Willard W. Cochrane, 1961-64
John A. Schnittker, 1964-65
Nathan M. Koffsky, 1965-66
Walter W. Wilcox, 1967-68
Don Paarlberg, 1969-

Source: (*5*; personnel records, U.S. Dept. Agr.).

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Optimum Plant Size and Location: A Case for Separable Programming

By J. L. Baritelle and D. W. Holland

A basic model is presented as an expansion of the general location model for optimal organization of an industry operating in spatial markets. Complications are introduced into the model: variations in raw product costs, inventory and carryover considerations, and multiproduct firms. Recent applications of the expanded model and problems encountered are discussed, and computer procedures useful in solving empirical applications are detailed.

Keywords: Location models, mathematical programming, cost analysis.

INTRODUCTION

Optimal organization of an industry operating in spatial markets is a classic problem area in agricultural economics. The literature is replete with the evolution of various approaches and modeling techniques for specifying optimal industry organization (*1, 4, 5, 7, 9*).

Stollsteimer, who pioneered this field, posited the following questions for the multiplant situation (*10*).

How many plants should we have?
Where should our plants be located?
How large should each plant be?
Where should the raw material processed in each plant be obtained?
What customers should be serviced by each plant?

Pointing out that these are interrelated questions, he offered an iterative solution to minimize the combined cost of assembling raw product supplies at various plants and the cost of processing the raw product into finished product. A linear longrun processing cost function was employed.

This article presents an expansion of the basic Stollsteimer model, in that it permits simultaneous consideration of assembly costs and distribution costs, and allows for nonlinear processing costs. The problem setting involves distinct geographic areas of raw product supplies for which costs per unit are fixed; transportation schedules delineating the cost to deliver the raw products to various plants; plant locations, present or potential, whose processing cost functions are known but not necessarily linear; and regions in which demand is assumed known and fixed.

The basic outline of this article may be summarized as follows:

1. Define the general location model verbally and mathematically;
2. Graphically depict the associated simplex tableau and discuss the IBM Mathematical Programming System/360 solution procedure;
3. Complicate the general location model by introducing variations in raw product costs, inventory and carryover considerations, and multiproduct firms; depict the respective simplex tableaus;
4. Review recent applications of the expanded model and discuss problems of application;
5. Detail computer procedures that have been found helpful in solving empirical applications.

THE GENERAL LOCATION MODEL

The following general location model can be used to determine the optimum size and location of an industry's plants and associated transportation patterns. It may be specified as:

$$\text{Minimize: } TC = \sum_{j=1}^{n} \sum_{i=1}^{m} t_{ij} R_{ij} + \sum_{h=1}^{p} \sum_{j=1}^{n} C_{jh} Q_{jh} + \sum_{j=1}^{n} \sum_{g=1}^{o} T_{gj} D_{gj} \qquad \text{Equation 1}$$

$$\text{Subject to: } \sum_{j=1}^{n} R_{ij} \leqslant S_i \quad i = 1,\ldots,m \qquad \text{Equation 2}$$

$$\sum_{j=1}^{n} D_{gj} \geqslant F_g \quad g = 1,\ldots,o \qquad \text{Equation 3}$$

where

TC = total industry cost (assembly, processing, and transportation costs).

t_{ij} = cost of transportation per unit of raw product from supply area i to plant j.

R_{ij} = the units of raw product from area i to plant j.

C_{jh} = cost of production per unit of output at plant j at point h on the average cost function of plant j.

Q_{jh} = the number of units of output at plant j at point h on the average cost function of plant j.

T_{gj} = cost of transportation per unit of final product from plant j to demand area g.

D_{gj} = the units of final product from plant j to demand area g.

S_i = maximum units of raw product available in area i available to various industry plants.

F_g = fixed demand in region g to be satisfied by one of the various industry plants.

The total cost function can be broken into the following segments:

$$\sum_{j=1}^{n} \sum_{i=1}^{m} t_{ij} R_{ij}$$

represents the transportation cost of assembling the raw product at the various plants;

$$\sum_{h=1}^{p} \sum_{j=1}^{n} C_{jh} Q_{jh}$$

represents the sum of the individual plant operating costs, which is a function output;

$$\sum_{j=1}^{n} \sum_{g=1}^{o} T_{gj} D_{gj}$$

represents the cost of distribution of the product from the various plants to the various points of fixed demand.

THE SIMPLEX TABLEAU

Figure 1 states the problem, equations 1, 2, and 3, in simplex format. Three areas are shown supplying raw product to two plants. The plants have nonlinear cost functions and supply four different markets. The desired solution is to find the least-cost way of assembling, processing, and distributing the final product while meeting constraints on supply and final demand.

Cost of Assembly and Production

The first section of the figure, "Raw Product Supplies," represents the cost of transporting raw product supplies to the processing plants (assembly). The supplies available in area 1 can go either to plant 1 at a cost of t_{11} or to plant 2 at a cost of t_{12}. The total supply from area 1 is equal to or less than S_1. Similar arguments can be made for supplies originating from areas 2 and 3. Supplies entering each plant are accumulated in the row "Supplies into Plant."

The costs of processing raw products within each plant (production) are represented by "Separable Cost Functions." It is assumed that total plant costs can be described by one variable output. For a complete, albeit brief, discussion of the derivation of cost curves, see (*1*). If there are no economies of size, the cost of each processing plant is fixed without regard to output and this cost can be represented with one cost coefficient in the objective function for each plant. Thus, with no economies of size, the problem becomes one of simple linear programming. However, the more realistic and interesting case involves nonlinear total cost functions.[1]

Figure 2 displays how a hypothetical nonlinear total cost function may be segmented to fit into a separable routine such as that depicted for plant 1.[2] The total cost curve for plant 1 is broken or segmented into increments of additional costs, C_{jh}, per additional units of output, Q_{jh}. The first increment of output is equal to Q_{11}, which represents a total cost of C_{11}. Q_{11} has a lower bound of zero and an upper bound of one in the figure. Thus, if plant 1's output is less than Q_{11}, that activity comes into the solution at the appropriate fraction of Q_{11} and at a cost of the same fraction of C_{11}. Thus, the total cost lies on the first line segment of figure 2.

When output exceeds Q_{11}, the cost activity C_{11} enters the solution at the upper bound of one and the remaining quantity is picked up by the second cost activity, Q_{12}. Q_{12} is the increment of output between Q_{11} and Q_{13} at an additional cost of C_{12}. This special activity is also bounded by zero and one. The last segment, Q_{13}, has a lower bound of zero in figure 2, but in the case presented in figure 1, Q_{13} is unbounded on the upper end. Thus, if the output exceeds Q_{11} plus Q_{12} plus Q_{13}, the cost of the additional output enters at the same cost per unit as the units on segment Q_{13}. The total cost to the plant equals the sum of the segmented quantities.

Cost of Product Distribution

The demand sector is represented in figure 1 under the title "Demand Locations." Certain quantities, F_g, are satisfied at given prices and transportation costs T_{gj}. The goods are transferred in the simplex state-

[1] For a detailed review of the separable programming approach in the IBM-Mathematical Programming System/360, see appendix 1. For a discussion of one method of estimating average cost functions, see appendix 2.

[2] For a complete discussion of the "delta method" of segmenting nonlinear functions, see (*2*).

Simplex Statement of Initial Problem

Bounds	Activities: Raw Product Supplies												Constraints
					Separable Cost Functions: Plant Cost Functions								
	t_{11}	t_{12}	t_{21}	t_{22}	t_{31}	t_{32}	C_{11}	C_{12}	C_{13}	C_{21}	C_{22}	C_{23}	
Supply From Area 1	1	1											$\leq S_1$
Supply From Area 2			1	1									$\leq S_2$
Supply From Area 3					1	1							$\leq S_3$
Supplies into Plant 1	-1		-1		-1		Q_{11}	Q_{12}	Q_{13}				
Supplies into Plant 2		-1		-1		-1				Q_{21}	Q_{22}	Q_{23}	
Finished Product Out Plant 1							$-Q_{11}$	$-Q_{12}$	$-Q_{13}$				
Finished Product Out Plant 2										$-Q_{21}$	$-Q_{22}$	$-Q_{23}$	
Fixed Demands Region 1													$\geq F_1$
Fixed Demands Region 2													$\geq F_2$
Fixed Demands Region 3													$\geq F_3$
Fixed Demands Region 4													$\geq F_4$

Demand Locations								
T_{11}	T_{12}	T_{13}	T_{14}	T_{21}	T_{22}	T_{23}	T_{24}	
1	1	1	1					
				1	1	1	1	
1				1				
	1				1			
		1				1		
			1				1	

Figure 1

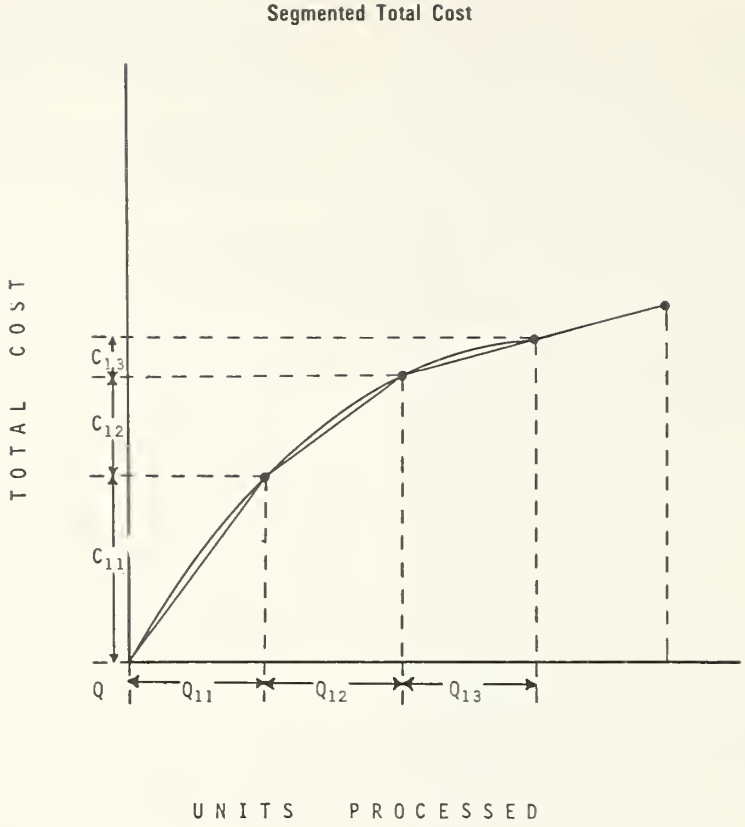

Figure 2

ment to the demand sector from the processing plants through the "Finished Product Out . . . " rows. The output from plant 1 can be distributed over any or all of the four demand locations at a cost of T_{gj}. The demands must be equaled or exceeded. Because the problem is cost minimization and the demands are specified in terms of cost, the demands generally will just be met. The model is specified in this manner to aid computational efficiency. Forcing the computer to meet these demands exactly can frequently increase computational costs.

The model as specified in figure 1 considers supply inputs and demand outputs in the same units. In other words, one unit of input is equal to one unit of output. Similarly, the units of costs t_{ij}, C_{jh}, and T_{gj} are measured in the same common denominator, either units of input or units of output. If it is desirable to include a conversion factor that permits raw product to be converted into final output, an appropriate set of vectors can be included on either side of the plant cost functions. If the plant cost functions are specified in terms of final output, a set of vectors on the left side of the plant cost functions containing the output/input ratio should be included. If the plant cost functions are specified in terms of raw product supplies, the output/input ratio should be included on the right side of the plant cost functions.

VARIATIONS OF THE GENERAL LOCATION MODEL

Inclusion of Raw Product Costs Plus Transportation Costs

Variations on the general location model permit a wide range of applications. The model can include the cost of raw product plus transportation costs, presuming raw product prices are known and fixed. This version of the model might represent the multiplant firm wishing to satisfy certain final demands, F_j, in view of differing input prices. This problem is essentially the same as the previous one, cost of product distribution. However, t_{ij} equals the cost of transportation and purchase price of raw product from supply area i to plant j. Different supply areas can realistically be expected to have different supply prices. Thus, the model minimizes input supply costs (transportation plus purchase cost), processing costs, and distribution costs simultaneously while satisfying the specified demands.

Inventory or Carryover Considerations

Agricultural cooperative processing and marketing organizations are generally obligated to receive all raw product supplies from their growers. In such cases,

only transportation costs need to be considered since an agricultural cooperative does not practice price discrimination against its growers. Thus, in figure 3, the t_{ij}'s in the "Raw Product Supplies" represent assembly costs. Assuming the industry is forced to process all raw products supplied, the "Supply from Area 1" can go to plant 1 with an associated transportation cost t_{11} or to plant 2 at a cost of t_{12}. The total quantity supplied to the processing plants from area 1 must equal S_1. For reasons of computational efficiency, the constraints on the supply specify that the sum of raw product supplied from area 1 must equal or exceed S_1 rather than exactly equal S_1.

It is also possible to include a demand vector to represent an inventory of final product for each plant. The cost of carryover for the marketing period is represented by I_j. Certain minimum inventories are insurance against unforseen marketing problems. Figure 3 presents the picture of an industry forced to process a fixed amount of raw product supply and forced to market a fixed amount of finished product. Inventory must be maintained at certain minimum levels; however, any excess production can be placed into inventory at a cost of I_j. The algebraic expression of the model is:

$$\text{Minimize: } TC = \sum_{j=1}^{n}\sum_{i=1}^{m} t_{ij}R_{ij} + \sum_{h=1}^{p}\sum_{j=1}^{n} C_{jh}Q_{jh}$$

$$+ \sum_{j=1}^{n}\sum_{g=1}^{o} T_{gj}D_{gj} + \sum_{j=1}^{n} I_jD_j$$

$$\text{Subject to: } \sum_{j=1}^{n} R_{ij} \geqslant S_i \qquad i = 1, \ldots, m$$

$$\sum_{j=1}^{n} D_{gj} = F_i \qquad g = 1, \ldots, o$$

$$\geqslant M_j \qquad j = 1, \ldots, n$$

where all variables are defined as previously, and

I_j = the cost per unit of final product placed into plant j's inventory.

D_j = the quantity placed into plant j's inventory.

M_j = the minimum amount of plant j's final product considered necessary for carryover or inventory.

$\bar{R}_j$ = transformation ratio (output/input) of plant j.

Figure 3 includes the transformation vector which converts raw product supplies into units of final output. If plant 1 requires two units of raw product for one unit of final product, $\bar{R}_1$ equals one-half. Plant 2 might have an identical production process to plant 1 or it might be considerably different. If $\bar{R}_2$ equals one-third, it reflects plant 2's need for three units of raw product to get one unit of final product. Inventory needs are expressed in the "Inventory Required, Plant . . . " row. Inventory levels of at least M_1 are considered necessary carryover for the marketing period for plant 1 at a cost of I_1 per unit. Similarly for plant 2, levels of M_2 are necessary at a cost per unit of I_2. Inventory also permits any "surplus" production to accumulate rather than be forced on the marketplace.

Multiple-Product and Multiple-Market Considerations

The general location model can be expanded to handle several types of output resulting from the primary raw product supply. The problem of considering many products can be easily handled by assuming the production process of the products to be independent of one another. The model is simply expanded to include plants that process two or more products. Raw product supplies can go into any of the possible plants. Final demands for the various products are specified. Final demand for each final product at each demand region may be some target level set based on past performance.

Growers of certain agricultural commodities possess or potentially possess some ability to act as discriminating monopolists; they may wish to establish conditions under which revenues will be maximized in this multiple-market situation. If there are no close substitutes, a commodity group may separate markets both spatially and with respect to form. And if there is little industry competition, conditions exist for potential product and price discrimination. Growers of certain agricultural commodities whose production is confined to specific geographic areas and who have developed certain types of marketing organizations often may be able to act as discriminating monopolists.

To use the model for a multiple-market situation, assume the following conditions:

1. An agricultural industry whose structure and commodity type permits it to practice price discrimination between two markets, fresh and processed;
2. Total production predetermined in any given year;
3. Industry objective to maximize total revenue;
4. All production sold either fresh or processed or placed in inventory.

To maximize total revenues, production should be allocated to each market so that marginal revenue in each market is equal.

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Simplex Statement of Problem With Inventory

Bounds	Activities: Raw Product Supplies						Transformation Input to Output	Separable Cost Functions						Inventory		Demand Locations								Constraints
	t_{11}	t_{12}	t_{21}	t_{22}	t_{31}	t_{32}		C_{11}	C_{12}	C_{13}	C_{21}	C_{22}	C_{23}	I_1	I_2	T_{11}	T_{12}	T_{13}	T_{14}	T_{21}	T_{22}	T_{23}	T_{24}	
Supply From Area 1	1	1																						$\geq S_1$
Supply From Area 2			1	1																				$\geq S_2$
Supply From Area 3					1	1																		$\geq S_3$
Supplies into Plant 1	-1		-1		-1		R_1																	
Supplies into Plant 2		-1		-1		-1	R_2																	
Cost Function Plant 1							-1	Q_{11}	Q_{12}	Q_{13}														
Cost Function Plant 2							-1				Q_{21}	Q_{22}	Q_{23}											
Finished Product Output Plant 1								$-Q_{11}$	$-Q_{12}$	$-Q_{13}$				1		1	1	1	1					
Finished Product Output Plant 2											$-Q_{21}$	$-Q_{22}$	$-Q_{23}$		1					1	1	1	1	
Inventory Required Plant 1														1										$\geq M_1$
Inventory Required Plant 2															1									$\geq M_2$
Fixed Demand Region 1																1				1				$= F_1$
Fixed Demand Region 2																	1				1			$= F_2$
Fixed Demand Region 3																		1				1		$= F_3$
Fixed Demand Region 4																			1				1	$= F_4$

Figure 3

Thus, given demand equations for the fresh and processed quantities for each market, appropriate quantities for each market can be ascertained. These quantities provide the necessary information for the model represented in figure 4. There are now two plants representing fresh packing and two representing the processing sector. The problem is to minimize total cost of assembling the raw agricultural product at the various plants, processing and packing it, and to minimize distribution costs associated with fulfilling *a priori* demands. There is also a provision for inventory and carryover denoted in the inventory sectors and rows. M_1, M_2, M_3, M_4 represent the minimum carryovers deemed desirable at a cost of I_1, I_2, I_3, I_4 per unit for the respective plants. The model may be expressed algebraically as follows:

$$\text{Minimize: } TC = \sum_{j=1}^{n} \sum_{i=1}^{m} t_{ij} R_{ij} + \sum_{h=1}^{p} \sum_{j=1}^{n} C_{fjh} Q_{fjh}$$

$$+ \sum_{h=1}^{p} \sum_{j=1}^{q} C_{pjh} Q_{pjh} + \sum_{j=1}^{n} I_{fj} D_{fj}$$

$$+ \sum_{j=1}^{q} I_{pj} D_{pj} + \sum_{j=1}^{n} \sum_{g=1}^{o} T_{fgj} D_{fgj}$$

$$+ \sum_{j=1}^{q} \sum_{g=1}^{o} T_{pgj} D_{pgj}$$

where all the variables are defined as previously, and

C_{fjh} = cost of production per unit of fresh output at plant j at point h on the average cost function of plant j.

Q_{fjh} = the number of units of fresh output at plant j at point h on the average cost function of plant j.

C_{pjh} = cost of production per unit of processing output at plant j at point h on the average cost function of plant j.

Q_{pjh} = the number of units of processing output at plant j at point h on the average cost function of plant j.

I_{pj} = the cost per unit of placing processed product into inventory from plant j.

I_{fj} = the cost per unit of placing fresh product into inventory from plant j.

D_{pj} = the quantity of processed product from plant j.

D_{fj} = the quantity of fresh product from plant j.

R_{ij} = the transformation ratio (output/input) of raw product from area i to plant j.

Of course, the model has far wider application than in just this revenue maximizing case. Any criterion—institutional, structural, or economic—which entails quantity distribution poses a problem that allows use of the model to solve for final demand quantities.

Multiple-Product and Multiperiod Considerations

Agricultural industries may wish to do some long range planning with respect to plant size and location. Current as well as proposed alternative locations may be involved. Parametric routines can be used to specify a progression of cost minimizations into future years. By parametrically varying the objective function, transportation and plant costs or both may be changed. Similarly, parametric variations of right-hand side values of supply and demand quantities based on future estimates of supply and demand allow new cost minimization solutions.

If supplies may be inventoried or if carryovers are an important concern, the program must be conceptualized slightly differently. Using the multiproduct case previously delineated, the program must be specified in a recursive manner, including the following relationship:

$$D_{j,t} + \sum_{j=1}^{n} Q_{j,h,t+1} = D_{j,t+1}$$

$$+ \sum_{g=1}^{o} D_{g,j,t+1} \qquad j = 1, \ldots, n$$

where

$D_{j,t}$ = the quantity of finished product from plant j placed into inventory at time period t.

$D_{j,t+1}$ = the quantity of finished product from plant j placed into inventory at time period $t+1$.

$\sum_{j=1}^{n} Q_{j,h,t+1}$ = the sum of finished product output from plant j in time period $t+1$.

$\sum_{g=1}^{o} D_{g,j,t+1}$ = the sum of finished product output from plant j to demand areas g in time period $t+1$.

The equation expresses the identity that inventory from the previous period plus current production must equal current output sold plus that production going

Simplex Statement of Problem With Multiple Products

Activities: Raw Product Supplies; Transformations Inputs into Outputs

Bounds	t_{11}	t_{12}	t_{13}	t_{14}	t_{21}	t_{22}	t_{23}	t_{24}	t_{31}	t_{32}	t_{33}	t_{34}	Transformations Inputs into Outputs			
Supply from Area 1	1	1	1	1												
Supply from Area 2					1	1	1	1								
Supply from Area 3									1	1	1	1				
Supply into Plant 1	-1				-1				-1				R_{11}			
Supply into Plant 2		-1				-1				-1				R_{12}		
Supply into Plant 3			-1				-1				-1				R_{21}	
Supply into Plant 4				-1				-1				-1				R_{22}
Cost Function Plant 1													-1			
Cost Function Plant 2														-1		
Cost Function Plant 3															-1	
Cost Function Plant 4																-1
Finished Product Output Plant 1																
Finished Product Output Plant 2																
Finished Product Output Plant 3																
Finished Product Output Plant 4																
Inventory Required Plant 1																
Inventory Required Plant 2																
Inventory Required Plant 3																
Inventory Required Plant 4																
Fixed Demand Product 1 Region 1																
Fixed Demand Product 1 Region 2																
Fixed Demand Product 1 Region 3																
Fixed Demand Product 1 Region 4																
Fixed Demand Product 2 Region 1																
Fixed Demand Product 2 Region 2																
Fixed Demand Product 2 Region 3																
Fixed Demand Product 2 Region 4																

Activities: Separable Cost Functions (Product 1, Product 2); Inventory

Bounds	C_{11}	C_{12}	C_{13}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}	C_{41}	C_{42}	C_{43}	I_1	I_2	I_3	I_4
Supply from Area 1																
Supply from Area 2																
Supply from Area 3																
Supply into Plant 1																
Supply into Plant 2																
Supply into Plant 3																
Supply into Plant 4																
Cost Function Plant 1	Q_{11}	Q_{12}	Q_{13}													
Cost Function Plant 2				Q_{21}	Q_{22}	Q_{23}										
Cost Function Plant 3							Q_{31}	Q_{32}	Q_{33}							
Cost Function Plant 4										Q_{41}	Q_{42}	Q_{43}				
Finished Product Output Plant 1	$-Q_{11}$	$-Q_{12}$	$-Q_{13}$										1			
Finished Product Output Plant 2				$-Q_{21}$	$-Q_{22}$	$-Q_{23}$								1		
Finished Product Output Plant 3							$-Q_{31}$	$-Q_{32}$	$-Q_{33}$						1	
Finished Product Output Plant 4										$-Q_{41}$	$-Q_{42}$	$-Q_{43}$				1
Inventory Required Plant 1													1			
Inventory Required Plant 2														1		
Inventory Required Plant 3															1	
Inventory Required Plant 4																1
Fixed Demand Product 1 Region 1																
Fixed Demand Product 1 Region 2																
Fixed Demand Product 1 Region 3																
Fixed Demand Product 1 Region 4																
Fixed Demand Product 2 Region 1																
Fixed Demand Product 2 Region 2																
Fixed Demand Product 2 Region 3																
Fixed Demand Product 2 Region 4																

Activities: Demand Locations (Product 1, Product 2); Constraints

Bounds	Y_{11}	Y_{12}	Y_{13}	Y_{14}	Y_{21}	Y_{22}	Y_{23}	Y_{24}	Y_{31}	Y_{32}	Y_{33}	Y_{34}	Y_{41}	Y_{42}	Y_{43}	Y_{44}	Constraints
Supply from Area 1																	$\geq S_1$
Supply from Area 2																	$\geq S_2$
Supply from Area 3																	$\geq S_3$
Supply into Plant 1																	
Supply into Plant 2																	
Supply into Plant 3																	
Supply into Plant 4																	
Cost Function Plant 1																	
Cost Function Plant 2																	
Cost Function Plant 3																	
Cost Function Plant 4																	
Finished Product Output Plant 1	1	1	1	1													
Finished Product Output Plant 2					1	1	1	1									
Finished Product Output Plant 3									1	1	1	1					
Finished Product Output Plant 4													1	1	1	1	
Inventory Required Plant 1																	$\geq M_1$
Inventory Required Plant 2																	$\geq M_2$
Inventory Required Plant 3																	$\geq M_3$
Inventory Required Plant 4																	$\geq M_4$
Fixed Demand Product 1 Region 1	1				1												$\geq F_1$
Fixed Demand Product 1 Region 2		1				1											$\geq F_2$
Fixed Demand Product 1 Region 3			1				1										$\geq F_3$
Fixed Demand Product 1 Region 4				1				1									$\geq F_4$
Fixed Demand Product 2 Region 1									1				1				$\geq F_5$
Fixed Demand Product 2 Region 2										1				1			$\geq F_6$
Fixed Demand Product 2 Region 3											1				1		$\geq F_7$
Fixed Demand Product 2 Region 4												1				1	$\geq F_8$

Figure 4

into inventory. Each future year is now laid out in the model and each is linked recursively through the inventory vectors to include carryover.

APPLICATIONS OF THE EXPANDED MODEL

The wide versatility of the expanded model is demonstrated in its varied applications. Hein (*3*) first apalied it to derive least-cost organization of the livestock industry of eastern Washington. He determined the optimum number, size, and location of livestock auctions, considering costs of assembling cattle at auctions, auctioning costs, and distribution of cattle once sold. This problem partly resembled one of King and Logan (*7*). They used a linear programming approach and iterative and budgeting techniques to handle the nonlinear costs of processing.

Kloth and Blakley (*8*) utilized the separable programming technique to minimize the costs of assembly, processing, and distribution for the dairy industry under alternative assumptions of plant size restrictions and market shares.

Howard (*5*) also used the expanded model to ascertain the optimum size, number, and location of farm implement dealerships in the wheat-pea region of eastern Washington. His model depicted dealerships whose cost curves were a function of the level of retail sales. The transportation vectors were combined to represent the cost incurred by a farmer who went to the dealership and returned. Thus, assembly and distribution vectors were combined.

Holland and Baritelle (*4*) used the model to ascertain the optimum organizational structure of school districts in sparsely populated rural counties of eastern Washington. School costs were specified as a nonlinear function of average daily attendance. Assembly and distribution of students were combined into one set of vectors since school children generally leave from and return to the same location. Costs of picking up and returning students were made a function of distance from their home grid to school and back.[3]

The model has also been proposed for a segment of Washington's apple industry. A number of cooperative packing and marketing organizations handle a part of Washington's apples. Several of these plants are rather small and it has been suggested that they merge. Which growers should supply which packinghouse, what size should each packinghouse be, and who would sell to which market are questions that the model presented in this article is well suited to answer.

USEFUL PROCEDURES IN APPLYING THE EXPANDED MODEL

The expanded model is normative in that, given its assumptions, it tells how an industry should be organized. To evaluate the normative solutions, it is imperative to have a standard from which to measure. The standard can be current actual costs. However, because the model uses a cost curve, preferably an envelope curve, actual costs are biased upward for purposes of comparison. Thus, more than one model should be run.

The first model should represent current assembly and distribution patterns with processing costs taken from points on the envelope curve and not points lying above it. This setup can be accomplished either by hand budgeting or by programming and constraining the model to present patterns of assembly, processing, and distribution. The resulting standard of comparison may be used to evaluate alternative assembly, processing, and distribution patterns. A shortrun conceptual framework often provides a useful second model. The total cost curve is merely the variable cost function for each plant with certain upper and lower bound capacity constraints for plant volume.

The third model can represent the longrun situation by using a longrun total cost curve. This curve should include all costs such as capital costs. The manner in which various capital costs are handled should be a function of the questions being asked and the researcher's preferences. Capital costs, however, should be consistent for all plants. The desirability of possible future plant locations can be examined by including the costs of assembling raw products to and distribution of final products from the potential locations being examined. Virtually an infinite number of alternative model variations are possible.

One important technical aspect of the MPS/360 separable program deserves mention. Invariably the optimum obtained is a local, not a global solution. Under the criterion of minimization, a global solution is attainable if the feasible region is a convex set and the objective function is convex. When using linear constraints, as in the problems discussed in this article, a convex feasible region is formed, provided it is bounded. However, when linear segments are introduced as an approximation to a convex objective function, the new objective function is no longer strictly convex. The optimal value may only be an approximation of the global minimum. There is one further problem. Often the initial model constrained to represent a facsimile of existing conditions, the standard of comparison model, will exhibit a total cost less than the same model with many of the constraints removed. The problem develops because a local optima is found for the second model and the algorithm cannot see other possible lower cost solutions.

[3] The problem encountered in the school case was one of routing. Children are picked up in a pattern with other children and delivered home in the same fashion. The pattern is a function of the school they attend and the schools their neighbors attend. Thus, transportation costs per student are not independent of the geographic distribution of children. For most agricultural commodities, the routing problem should not be too serious, since these are generally assembled and distributed in truck or car load lots. However, routing difficulties may plague even agricultural commodities, particularly the assembly of raw materials.

The IBM-MPS/360 Linear and Separable Programming Manual (*6*) offers several remedies when this difficulty is encountered, such as running the dual instead of the primal. However, the most satisfactory relief in our experience is achieved by taking the basis from the constrained solution and parametrically varying the constraints from the standard model. The solution which is obtained may be a local optima, but it will be characterized by costs which are less than the facsimile of current conditions depicted in the first model. As a further check, the objective function can be systematically varied. By parametrically varying the objective function slightly, the feasible region can be further explored. If an area is found that might offer a lower total cost solution, the basis should be saved and the objective function parametrically varied back to its original values.

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APPENDIX I

IBM-MPS/360 and Nonlinear Functions

The IBM-Mathematical Programming System/360, linear and separable program (IBM-MPS/360) handles nonlinear functions within a general linear programming framework. The features of the separable program as delineated in the IBM-MPS/360 users' manual (*6*) are:

1. Any separable function, appearing in the problem as either an objective function or a constraint function, is represented by a piecewise linear function.
2. This piecewise linear function is expressed as a set of special variables.
3. Each variable in the problem which takes part in a separable function has a unique set of special variables associated with it.
4. Each special variable in a set defines a predetermined interval of the specified range of values of the associated separable function variable.
5. Equations are developed by the user which sum the contribution of each special variable to the values of the separable function variable and the separable function variable.
6. Logical restrictions are placed on these special variables, so that:
   a. All special variables must have a lower bound of 0, and an upper bound of 1. The only exception to the upper bound restriction is that the last special variable in the set need not be upper bounded.
   b. Special piecing requirements are used by this technique within each set of special vectors, so as to provide for a restricted basis entry within each set. At most, only one vector from each set may be in the basis of the problem at any one time.
   c. Only the basic vector may have an intermediate level value (between 0 and 1). All vectors in the set preceding the basis vector must be at their upper limit, while all following special vectors must be at their lower limit.
7. The solution to a separable programming problem is thus obtained by solving a linear programming problem formulated in terms of:
   a. The ordinary (nonseparable) variables of the separable programming problem.
   b. The separable function variables, insofar as their contribution to linear terms only is concerned.
   c. The associated set of special variables for each variable.

APPENDIX 2

Estimation of Nonlinear Cost Functions

There are any number of possible methods of fitting a curve to a group of cost-output observations. The ordinary least squares approach fits a curve through the data points but it fails to pass through the minimum-cost points. Linear programming can be used to minimize the difference between the observed points and predicted points, subject to the constraint that each predicted point is equal to or less than the observation point. Quadratic programming is also frequently used to minimize the squared difference between the observed points and predicted points, subject to the constraint that each predicted point is equal to or less than the observation point. However, quadratic programming gives disproportional weight to extreme observations.

Using linear programming, the form of the function fit is the following:

$$\widehat{C}_j = \widehat{\beta}_0 - \widehat{\beta}_1 Q_j + \widehat{\beta}_2 Q_j^2 \qquad j = 1, \ldots, n$$

where

C_j = the estimated cost per unit of output for firm j.

Q_j = the output of firm j.

The linear programming problem is thus specified as:

$$\text{Minimize: } \sum_{j=1}^{n} (C_j - \widehat{C}_j) \qquad j = 1, \ldots, n$$

$$\text{Subject to: } \widehat{C}_j \leqslant C_j \qquad j = 1, \ldots, n$$

$$\widehat{\beta}_0, \widehat{\beta}_1, \widehat{\beta}_2 \geqslant 0$$

where:

C_j = the cost per unit of output for firm j.

The objective function can be rewritten as:

$$\text{Minimize: } \sum_{j=1}^{n} (C_j - (\widehat{\beta}_0 - \widehat{\beta}_1 Q_j + \widehat{\beta}_2 Q_j^2)$$

which is equivalent to

$$\text{Minimize: } \left(\sum_{j=1}^{n} C_j - \sum_{j=1}^{n} (\widehat{\beta}_0 - \widehat{\beta}_1 Q_j + \widehat{\beta}_2 Q_j^2) \right)$$

Because the $\sum_{j=1}^{n} C_j$ is given from the data set and therefore fixed, the same objective can be accomplished by

$$\text{Maximize: } \sum_{j=1}^{n} (\widehat{\beta}_0 - \widehat{\beta}_1 Q_j + \widehat{\beta}_2 Q_j^2)$$

Hence, the unknown beta's can be estimated, providing an envelope curve to the data by specifying the following linear programming problem:

$$\text{Maximize: } \sum_{j=1}^{n} (\widehat{\beta}_0 - \widehat{\beta}_1 Q_j + \widehat{\beta}_2 Q_j^2)$$

$$\text{Subject to: } \widehat{\beta}_0 - \widehat{\beta}_1 Q_1 + \widehat{\beta}_2 Q_1 \leqslant C_1$$

$$\vdots$$

$$\widehat{\beta}_0 - \widehat{\beta}_1 Q_n + \widehat{\beta}_2 Q_n \leqslant C_n$$

and

$$\widehat{\beta}_0, \widehat{\beta}_1, \widehat{\beta}_2 \geqslant 0$$

Cost of Unemployment Insurance for Farmworkers in Selected States

By Joachim Elterich and Richard Bieker

Regression analysis with data for 12 Northeastern States, Ohio, Florida, and Texas explains 93 percent of the variation in cost rates of unemployment insurance coverage among these States. Of the explained variation in the cost rates of such coverage for farmworkers, 57 percent is accounted for by system variables and 43 percent by labor force variables. Simulation with a fixed population spotlights the widely varying influences of different States' qualifying and benefit schedule requirements. Average total benefits per worker ranged from $266 to $486. An attempt was made to adjust the benefit payments to allow for the cost of living in each State.

Keywords: Agricultural labor; unemployment insurance.

American agricultural workers have been excluded from most social legislation, including unemployment insurance, since the 1930's. The U.S. unemployment insurance system originated as part of the Social Security Act of 1935. The system's major objectives were (1) employment stabilization of industries, (2) aggregate income maintenance in the economy, and (3) personal income maintenance for individual workers. The counter-cyclical effects of the program are further amplified because the contributions to the unemployment insurance (UI) trust fund are usually paid exclusively by employers. The taxes are levied on a proportion of the gross payroll of employees.

By 1938, all States had passed bills that included them in the cooperative Federal-State unemployment insurance program, but these bills exempted agricultural workers from coverage. Initially, two major reasons were given for this exemption. First, it was argued that agriculture's employment pattern—the large number of farms with small numbers of employees—made the program administratively unworkable. Second, it was argued that the seasonality of agricultural employment would result in large benefit payments which would threaten the solvency of the insurance system.

Agricultural workers continued to be excluded from coverage until 1974, except in specified instances in Hawaii, Minnesota, the District of Columbia, and Puerto Rico. In other States, agricultural employees could voluntarily elect coverage. Today, agricultural workers in all States are temporarily covered under the Special Unemployment Assistance Act, enacted by the Congress on December 19, 1974.

Exclusion has begun to be challenged on the grounds that it is not equitable to hired farmworkers compared with other wage earners. But discussions on extending unemployment insurance to agriculture continue to be dominated by concerns about the seasonal employment patterns assumed to be characteristic and the effects such patterns would have on the costs of the unemployment insurance system. To provide some answers to the questions about these costs, the U.S. Department of Labor initiated in 1969 a series of studies designed to estimate the costs of extending unemployment insurance to hired farmworkers in a number of States.[2] Findings indicate considerable variation from State to State. The cost rates (expressed as benefits paid out to insured workers as a percentage of taxable payroll) in 15 States surveyed range from 0.76 to 6.71 percent.[3]

The purposes of this article are (1) to develop a regression model to explain the variation in the cost rate among the States surveyed and (2) to analyze, using simulation, the variation of State UI provisions.

THE MODEL

The cost of extending unemployment insurance to hired farmworkers in any given State depends upon (1) the proportion of covered farmworkers qualifying for benefits (insured workers), (2) the duration of their compensable unemployment, and (3) the level of benefits (weekly benefit amount) they receive when unem-

[1] Some of the material presented here was prepared under grant UIS72-9, Manpower Administration, U.S. Department of Labor. Subsequent work was performed under the auspices of regional research project NE-58 cooperatively sponsored by USDA's Cooperative State Research Service and Agricultural Experiment Stations.

[2] These studies are summarized in (*1*, *3*, and *8*).

[3] See (*3*, p. 13; *1*, p. 3.24). The States are: Connecticut, Delaware, Florida, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Texas, Vermont, and West Virginia.

ployed. These values are determined by the nature of the unemployment insurance system of the State as well as workers' employment patterns.

To be potentially eligible for benefits during the benefit year, a worker must earn a specified amount in wages during a base period from employers covered by the unemployment insurance system. If the worker earns sufficient wages during this base period, he or she may receive benefits during the benefit year provided the worker experiences one or more weeks of compensable unemployment. The amount of benefits workers actually receive during the benefit year depends upon their weeks of compensable unemployment, the level of wage credits they earned during the base period, and the benefit payment schedule of the State.

Employers generally pay the cost of worker unemployment insurance payments.[4] UI trust fund taxes all covered employers, except new entrants, according to the level of compensable unemployment experienced by their workers. However, minimum and maximum tax rates are established; as a result, the ratio of benefits paid out to workers and taxes paid into the fund by employers varies among employers.[5] UI provisions vary considerably among States, and obviously this variation affects the cost rate (*1, 9, 10*).

In addition to differences in the unemployment insurance provisions, the composition of agricultural production—farm size and type—varies among States. This variation results in differences in employment patterns in the hired farm labor market.

The model for explaining the variation in the cost rate among States incorporates variation in both the unemployment insurance provisions and in employment patterns in the hired farm labor market. Specifically, the following functional relationship is proposed:

$$C = f(LF, UI)$$

where C is the cost rate, expressed as the benefit payments to hired agricultural farmworkers in a given State as a percentage of the taxable payroll of agricultural employers in that State; LF is a vector of hired agricultural labor force variables; and UI is a vector of unemployment insurance system variables. The variables are specified in the paragraphs below.

The cost rate is specified as

$$(1)\quad \frac{(\text{Benefit payments to hired agricultural workers})}{(\text{Taxable payroll of agricultural employers})} \times 100.$$

The present minimum-coverage criterion for covered employers, established by Federal statute, is employment of one or more workers for 20 weeks or more or a high-quarter payroll of $1,500 or more. Data from the 15 States surveyed indicate that little variation occurs within a State in the cost rate for agricultural coverage over a broad range of coverage criteria (*1*, p. 3.43). The cost rate used here is based on the assumption of universal coverage; that is, all agricultural employers who hire one or more workers for at least 1 day are covered. The values for the cost rate are taken from (*3*, p. 13 and *1*, p. 3.24).

The following work force characteristics are important, *a priori*, in explaining the State cost rates:[6]

Average duration of unemployment in weeks (DU) for all farm workers in the ith State ($b>0$)

Insured workers without unemployment (WOU) in the ith State ($b<0$) defined as the difference between the proportion insured workers are of all farmworkers and the proportion beneficiaries are of all farmworkers.

Other variables, such as seasonal and nonfarm employment opportunities and average annual earnings, turned out not to be significant nor to contribute to the determination of the cost rate.

Basically, the above combination of characteristics is intended to capture the effect of three underlying work force characteristics, employment, earnings in covered employment, and unemployment. If the program variables are held constant—that is, if there existed uniform eligibility and benefit payment determinants in all States—the remaining variability among States should be accounted for by these work force characteristics. Or if the work force characteristics were held constant, the remaining variability among States should be accounted for by their UI program variations.

Differences in the unemployment insurance programs among the States result, among other things, from (1) different rates of compensation and duration for workers who qualify for benefits and (2) differences in qualifying requirements. The following system variables have been included in the model:

Median dollar amount per week in the benefit payment schedule (B) of the ith State ($b>0$)

Minimum high-quarter earnings to qualify for benefits (HQ) in the ith State ($b<0$)[7]

Minimum weeks of covered employment to qualify for benefits (MW) in the ith State ($b<0$)[8]

Other system measures, such as minimum base period earnings and total benefit amount per beneficiary, were considered but proved statistically insignificant.

[4] In New Jersey, as of August 1971, the workers contribute 0.25 percent of their gross wages, (*9*, January, p. T-5).

[5] New entrants are taxed at the standard rate of assessment, a rate between the minimum and maximum rates. The tax is levied on the first $4,200 paid by each employer each year.

[6] The hypothesized relationship between the explanatory variables and the cost rate is indicated in parenthesis for each variable.

[7] Though all State UI laws do not have a statutory requirement concerning minimum weeks of employment or high-quarter earnings, all qualifying requirements call for a minimum length of employment and a minimum amount of earnings in a quarter for that quarter to be the individual's high quarter.

[8] See footnote 7.

After the above set of variables has been reviewed, it should be apparent that the explanatory variables are not completely independent. Indeed, the initial specification scheme has purposely been liberal so as not to exclude any meaningful variables.

Interpretation of the results depends on some assumptions and limitations resulting from the data.

There may be some question as to whether the work-leisure indifference of workers after UI coverage differs significantly from their behavior before such coverage takes effect. Work by R. Emerson simulating some drastic changes in the attitudes of migrants toward the leisure-work mix suggests that the effects will be rather minimal.

The analysis in this article is based on 1971 statutes and 1969-70 data on workers and employers; therefore, it reflects only the situation prevailing then. The detailed work history data enabling this analysis are not available for later years. However, the conditions we studied are believed generally similar today. Though wages, contributions, and, in some States, benefit schedules have increased, the magnitude of the cost rates has not changed much.

Assumptions concerning disqualifications for nonmonetary reasons had to be made. For instance, fired workers or those unemployed workers not willing and not able to work are ineligible for UI benefits. Because of data limitations in this study, such workers were assumed to be eligible. All the simplifications have the tendency to overstate the cost rate to a small extent.[9]

It was assumed that workers who were interviewed in a State surveyed would also file their claims in that State. Subsequently, their claims would be processed in accordance with that State's payment schedule, although benefits are allocated among States on a prorated basis with respect to covered wages. For intrastate workers, the problem does not arise. However, interstate workers actually may file their claim in any State in which they are monetarily eligible, and they may receive benefits in accordance with the State in which they filed. The cost rates used in the study do not include any administrative costs connected with the program; such costs, a constant throughout all States surveyed, are 0.5 percent of the taxable gross payroll. The standard cost rate of UI benefits, including the State and Federal shares, amounts to about 3.2 percent.

ANALYSIS OF VARIATION IN COST RATES AMONG STATES

To examine the combined influences of the work force and system variables in explaining the cost rates of UI benefits in the States surveyed, a regression model was developed:

$$(2)\quad C_i = 3.75 - .034^{***}HQ_i + .107^{***}B_i + .183^{**}DU_i$$
$$(3.98)\ (.006)\qquad (.017)\qquad (.049)$$

$$- .033^{*}MW_i - .023\ WOU_i$$
$$(.021)\qquad (.018)$$

$$R^2 = .93, \bar{R}^2 = .90, F = 25.15, df = 9$$

***, **, *: significant at the 0.01, 0.05, and 0.10 levels, respectively

where:

C_i = Estimated cost rate in the ith State,

HQ_i = Minimum high-quarter earnings for qualification for benefits in the ith State,

B_i = Median dollar amount in the benefit payment schedule of the ith State,

DU_i = Average duration of unemployment per worker, in weeks, in the ith State,

MW_i = Minimum weeks of covered employment for qualification for benefits in the ith State, and

WOU_i = Proportion of insured farmworkers without unemployment in the ith State.

Regression analysis was performed in linear form, and these five variables explained 93 percent of the variations in the cost rates. Examination of the partial correlation coefficients does not suggest an intolerable degree of collinearity. The highest partial correlation coefficient, between the high-quarter earnings requirement and median benefit amount, is 0.86, which is to be expected. All the other partials have values of 0.66 or lower, most of them indicating no intercorrelation at all. Most of the coefficients of the variables are significantly different from zero—at least at the 92.5 percent level. Table 1 contains the observed and estimated values.

Forty-two percent of the variation in the cost rate is accounted for by the minimum high-quarter earnings requirement, another 37 percent by the median scheduled benefit amount, and 4 percent by the minimum weeks of work requirement. Thus, system variables account for 83 percent, while the work force variables account together for 10 percent of the variations in the cost rate. Beta coefficients also indicate that the system variables outweigh work force variables, 1.54 to 0.50.

Specifically, a 10-percent increase in the minimum high-quarter earnings requirement decreases the cost rate by 0.34 percentage point. This means that the cost rate of 3.20 percent will decrease to 2.86 percent if the

[9] For a detailed discussion of these issues, see (*5*, pp. 37-40 and *6*, pp. 32-35 and pp. 41-44). The data for these workers were obtained in conjunction with (*1*).

Table 1. Observed and estimated cost rates for UI of farm workers, by 15 States surveyed, 1969-70

States	Observed cost rate	Estimated cost rate	Deviation of observed from estimated rate
Connecticut	6.71	6.68	0.03
Delaware	5.10	4.38	0.72
Florida	3.11	2.41	0.71
Maine	2.06	1.88	0.18
Maryland	1.54	1.70	-0.16
Massachusetts	2.98	2.60	0.38
New Hampshire	2.40	2.43	-0.03
New Jersey	5.81	6.38	-0.57
New York	1.57	2.30	-0.73
Ohio	4.22	3.97	0.25
Pennsylvania	1.62	2.52	-0.90
Rhode Island	5.09	4.81	0.28
Texas	3.47	3.72	-0.25
Vermont	0.76	0.75	0.01
West Virginia	1.44	1.36	0.08

Sources: The observed cost rates for all States except Texas are derived from (8), with worker tabulations computed by persons at Cornell University and the Pennsylvania State University. Conrad Fritsch, Department of Agricultural Economics, Texas A & M University, supplied the rate for Texas.

high-quarter requirement increases by $13.36, or the rate will increase to 3.54 percent if the high-quarter requirement decreases by $13.36. Higher qualifying requirements will have a tendency to decrease the cost rate, *ceteris paribus*.

If the median of the weekly benefit schedule increases by $1, the cost rate rises 0.11 percentage point. This result implies an increase of the cost rate from a base of 3.20 percent to 3.31 percent because of a $2 change in the upper limit of the weekly benefit schedule with the minimum unchanged.

A lengthening in the duration of unemployment by 1 week raises the cost rate 0.18 percentage point. Also, 1 additional week of the defacto requirements decreases the cost rate 0.03 percentage point.

A 1-percent deviation in the proportion of insured workers without unemployment is associated with a negative change of 0.02 percentage point in the cost rate. Thus, a cost rate of 3.20 percent, for example, increases to 3.22 percent if the number of insured workers without unemployment declines by 1 percent. Given a tax base, it is to be expected that a higher proportion of beneficiaries, *ceteris paribus*, will cause a higher cost rate.

Though some deviations exist between the two rates among low-cost States (below 2 percent), they are relatively smaller among high-cost States. For policy purposes, it is much more essential to arrive at accurate estimates for States with cost rates of 4 percent and more.

ANALYSIS OF THE VARIATION BETWEEN STATE UI PROVISIONS

Here, the concern is how State UI provisions vary in their qualifying requirements and amounts of compensation. To determine the impact of differences in State UI provisions, it is necessary to eliminate differences in work force characteristics. One method is to consider the proportion of insured workers and beneficiaries, benefits, and cost rates that accrue to a fixed set of workers under the State UI provisions of the 15 States. Specifically, we simulate the proportion of beneficiaries, benefits, and cost rates that accrue to 632 West Virginia and Delaware survey workers when considered using the 15 States' UI provisions.[10] Nonmonetary considerations—such as willingness and ability to work, and disqualifications—were not considered. Thus, any differences among States that may result from different interpretations of these rules are disregarded. The results appear in tables 2, 3, and 4.

Qualifying Requirements

The proportion of insured workers ranges from 77 percent under Vermont's provisions to 87 percent under Maine's provisions, and the median State is Pennsylvania with 84.5 percent (table 2). The proportion of beneficiaries ranges from 29 percent under Massachusetts' provisions to 35 percent under Connecticut's provisions; the median State is Maine with 31 percent. The proportion that benefit exhaustees (workers who exhaust all benefit payments due them) are of beneficiaries ranges from 3.7 percent under Pennsylvania's provisions to 26.9 percent under Texas' provisions. The median State is Delaware with 9.7 percent.

The proportion of all workers with sufficient wages to qualify for benefits (insured workers) reflects the restrictiveness of the provisions with respect to qualifying requirements. Because of differences in these requirements, a much greater proportion of workers qualify for benefits in Maine, for example, than in Vermont. This restrictiveness in turn, limits the proportion of beneficiaries, since workers must be insured before they can receive benefits. The incidence of benefit exhaustees is determined by the restrictiveness of the qualifying requirements as reflected (1) by the proportion of insured workers and beneficiaries and (2) by differences in State laws as to the duration of benefit payments. The significance of the latter restriction is illustrated by the fact that the ranking of States as to proportion of beneficiaries does not correspond to their ranking as to the ratio of exhaustees to beneficiaries.

[10] It was argued that the combination of a low-cost State (West Virginia) with a relatively constant employment level and a high-cost State with heavy seasonal employment (Delaware) represents the conditions of the 15 States surveyed.

Table 2. Insured workers, beneficiaries, and exhaustees under UI provisions of States surveyed, based on Delaware and West Virginia farm labor force data, July 1971

State	Insured workers[a]		Beneficiaries[b]		Exhaustees[c]	
	Percent	*Rank*	*Percent*	*Rank*	*Percent*	*Rank*
Connecticut	86.3	13	35.1	15	10.7	9
Delaware	86.6	14	34.5	13	9.7	8
Florida	82.6	5	30.8	4	22.7	13
Maine	87.2	15	31.3	8	25.7	14
Maryland	86.0	11	34.3	12	8.2	6
Massachusetts	81.6	3	29.2	1	14.3	11
New Hampshire	86.0	12	31.5	10	9.5	7
New Jersey	83.4	7	31.3	9	10.9	10
New York	80.0	2	34.8	14	5.7	2
Ohio	81.8	4	30.8	5	6.7	4
Pennsylvania	84.5	8	30.6	2	3.7	1
Rhode Island	82.8	6	30.9	6	19.0	12
Texas	84.8	9	30.6	3	26.9	15
Vermont	77.0	1	32.8	11	6.3	3
West Virginia	85.8	10	31.1	7	8.0	5

[a]As a percentage of all workers with farm or nonfarm wage credit or both. [b]As a percentage of insured workers with farm or nonfarm wage credit or both. [c]As a percentage of beneficiaries with farm or nonfarm wage credit or both. Exhaustees are workers who exhaust all benefits due them.

Table 3. Average total and weekly benefits and compensable weeks for beneficiaries under UI provisions of States surveyed, based on Delaware and West Virginia farm labor force data, July 1971

State	Average total benefit amounts		Average weeks of compensable unemployment		Average weekly benefit amounts	
	Dollars	*Rank*	*Number*	*Rank*	*Dollars*	*Rank*
Connecticut	421	13	11.4	11	36.90	8
Delaware	381	8	10.8	7	35.32	6
Florida	305	2	9.5	2	32.27	3
Maine	412	12	10.5	6	39.23	14
Maryland	423	14	11.3	10	37.56	10
Massachusetts	365	5	9.3	1	39.15	12
New Hampshire	352	3	11.8	15	29.78	2
New Jersey	486	15	11.5	13	42.33	15
New York	370	6	11.0	9	33.69	5
Ohio	358	4	10.9	8	32.83	4
Pennsylvania	409	11	11.5	14	35.44	7
Rhode Island	374	7	10.0	3	37.29	9
Texas	384	9	10.1	4	37.98	11
Vermont	397	10	10.1	5	39.19	13
West Virginia	266	1	11.5	12	23.16	1

Table 4. Compensable weeks unemployed, potential and actual benefits, and cost rates under UI provisions of States surveyed, based on Delaware and West Virginia farm labor force data, July 1971[a]

State	Total weeks of compensable unemployment		Potential benefits		Actual benefits[b]		Cost rates[b]	
	Number	*Rank*	*1,000 dollars*	*Rank*	*1,000 dollars*	*Rank*	*Percent*	*Rank*
Connecticut	26,159	15	6,808	12	965	15	5.0	15
Delaware	24,403	13	6,133	8	862	12	4.5	12
Florida	18,221	2	4,826	1	588	2	3.1	2
Maine	21,665	7	6,053	7	850	11	4.4	11
Maryland	25,108	14	6,660	11	943	13	4.9	13
Massachusetts	16,784	1	6,477	9	657	3	3.4	3
New Hampshire	24,199	12	6,611	10	721	5	3.8	5
New Jersey	22,667	9	6,967	13	960	14	5.0	14
New York	23,165	10	5,557	4	780	9	4.1	9
Ohio	20,755	6	5,870	6	681	4	3.6	4
Pennsylvania	22,591	8	7.089	15	801	10	4.2	10
Rhode Island	19,475	4	7,002	14	726	6	3.8	6
Texas	19,872	5	5,231	3	755	7	3.9	7
Vermont	19,394	3	5,625	5	760	8	4.0	8
West Virginia	23,202	11	4,987	2	537	1	2.8	1

[a]The taxable wage bases for Delaware and West Virginia were $10,425,000 and $8,713,000 respectively. [b]For cost rate, Duncan's Multiple Range Test showed significant differences at the 5-percent level among means ordered in groups of 3.

Amount of Compensation

Another important difference in State unemployment insurance provisions is the variation in benefit payments to workers who are beneficiaries; that is, differences in rates (and duration) of compensation. That such differences exist by State is amply demonstrated by the average weekly benefit amounts (table 3). Beneficiaries in West Virginia receive only $23 a week compared with $42 in New Jersey. The State with median benefits is Connecticut with $37. These differences primarily result from differences in the benefit payment schedules. In West Virginia, $700 in base period wages is required to qualify for the minimum weekly benefit amount of $12, compared with only $255 for the minimum weekly benefit of $10 in New Jersey. At the upper end of the benefit scale, it takes $9,050 in base period wages to qualify for the maximum $71 a week in West Virginia but only $1,811 in base period wages for the maximum $72 in weekly benefits in New Jersey.

To summarize, the variation in cost rates among the States partly results from the interstate variation in UI provisions, specifically as to their qualifying requirements and rates of compensability. The combined influence of these two factors is shown by the variation in the cost rate, the total covered wage base (not reproduced in this article), total potential and actual benefit amounts, and the weeks of compensable unemployment—for a fixed set of workers "filing" under different States' provisions (table 4). Under West Virginia's provisions, the cost rate is 2.8 percent compared with 5.0 percent in Connecticut. The median rate of 4.0 percent results under Vermont's provisions.

Considering potential and actual benefits, taxable wage base, and cost rate for survey workers with only farmwork reduced all figures. However, in general, the ranking of the States remained the same. The cost rate for this subset of workers declined appreciably by 0.5 to 1.0 percent. Thus including farmwork under the unemployment insurance program appeared to help reduce the cost rate, as judged by the results obtained from this constant work force. This may be a somewhat expected result if one considers that migrants have proportionately more nonfarm employment than nonmigrants.

An important factor to consider when comparing benefits paid to the standardized set of workers under the statutes of the different States is the variation in the cost of living in each State. Accordingly, the weekly and total benefits are adjusted by the regional Consumer Price Index for nonmetropolitan areas (app. table). Ranges in the adjusted weekly and total benefit amounts are less than in the unadjusted amounts. Unadjusted weekly and total benefit amounts for the lowest ranking State are both 55 percent as large as the benefits in the highest State. Adjusted weekly and total benefits for the lowest ranking State are 59 and 60 percent as large, respectively, as those in the highest ranking State. But, when the 15 States were divided into groups of five for adjusted weekly benefits, the average weekly benefits were found to differ significantly between all three groups at the 5-percent level. By an independent grouping in a similar manner, adjusted total benefits

also differed significantly between all groups at the 5-percent level.

After adjusting for differences in purchasing power, the total benefits of Florida, Texas, and West Virginia increase by $35, $59, and $30. The corresponding increases for the weekly benefits amount to $3.72, $5.84, and $2.67.

Clearly, no uniformity exists among the States as to how they insure the loss of personal earnings of workers during periods of involuntary unemployment. As a result of the differences in benefit payments, cost rates also differ appreciably.

CONCLUSIONS

Using the beta coefficients measure and contributions to R^2, we can conclude that the importance of the variables reflecting work force characteristics and system variables carry weights of about 1:3 in equation (2). As confirmed by our study, work force characteristics contribute relatively less than system variables in determining the cost rate. Such system variables as minimum monetary and work requirements for qualification are important factors. So are the benefit schedules. The differences in benefits result partly from the differences in the amount of wage credits needed to qualify for given weekly benefits. Based on the equation, qualifying requirements account for about 57 percent of the explained variation of the system variables and benefit schedule differences explain 43 percent. This finding has obvious and severe implications for insured migrants who are able to file in different States. In the long run, continued drastic differences in the benefit schedules may have a diversionary effect on the migrant stream, since for a given work history (earnings) these workers could receive double the benefits in one State compared with another.

In equation (2) the following changes in the program or work force variables will cause substantial variation (12.5 percent at the mean) in the cost rate if a 3.2-percent base is assumed:

- 12 weeks as the minimum qualifying requirement for weeks of work (negative relationship),
- $11.80 as the minimum qualifying requirement for high quarter (negative relationship),
- $3.74 as the median weekly scheduled benefits (positive relationship),
- 2.2 weeks as the duration of unemployment (positive relationship), or
- 17 percent as the proportion of insured workers without unemployment (negative relationship).

As judged by the significance levels, magnitudes, and signs of the coefficients, the model satisfies statistical and economic reasoning in explaining most of the variation in the cost rates of the 15 States. The signs also confirm all the hypotheses established for the model to prove. The model could be used to simulate and to analyze the possible outcomes of alternative policies which would precipitate changes in the independent variables employed.

As judged by the observed cost rate (and the share of agricultural benefits to total benefits), most of the 15 States have rates below 3.5 percent. Furthermore, agricultural benefits as a share of total benefits are a small proportion (less than 5 percent, except for Florida and Texas where they are 25 and 19 percent, respectively) for the States. Thus agriculture would hardly cause a severe drain on the States' UI funds. It is expected that in four States (with cost rates over 4.3 percent, which approaches the maximum chargeable rate in these States), agricultural employers would be subsidized by nonagricultural employers. In seven States (with less than a 2.5-percent cost rate), the opposite would hold, since most States do not drop the tax rate below a given level even after experience rating of employers has been accounted for.[11] These likely developments carry implications for aspects of rural development and income redistribution from nonfarm employers to farmworkers or from farmers to nonfarm workers.

A shortcoming of the model is the limited degrees of freedom, given by the narrow data base. Further testing of the models developed will be undertaken with data for all contiguous States of the Nation. Since no survey data are available for the remaining 33 States, proxies from secondary sources must be found to fill the void.

Finally, substantial differences exist in the UI provisions among the 15 States. If a given work force applied for benefits in these States, proportions of insured workers, beneficiaries, and exhaustees would vary greatly. In addition, this work force would obtain benefits in one State that are almost double those in another, and it would be eligible for benefits for varying durations. The UI benefit payments were adjusted by an appropriate consumer price index to arrive at the real purchasing power of benefit payments in different States. After adjustment was made to determine real purchasing power of benefit payments, Southern States ranked much more favorably in their payments than did some Northern States.

[11] Each employer establishes over a period of time, usually 3 years, part of what that employer's tax rate will be, based on benefits paid to workers laid off.

Appendix table.
Average total and weekly benefit amounts deflated by regional Consumer Price Index for States surveyed, based on Delaware and West Virginia farm labor force data, July 1971[a]

State	Average total benefits (real terms)		Average weekly benefits (real terms)	
	Dollars	*Rank*	*Dollars*	*Rank*
Connecticut	428	12	37.53	8
Delaware	388	8	35.92	5
Florida	340	2	35.99	6
Maine	414	10	39.49	12
Maryland	430	13	38.20	10
Massachusetts	371	5	39.81	13
New Hampshire	354	3	29.98	2
New Jersey	494	15	43.05	14
New York	376	6	34.26	4
Ohio	362	4	33.27	3
Pennsylvania	416	11	36.04	7
Rhode Island	381	7	37.92	9
Texas	443	14	43.82	15
Vermont	400	9	39.45	11
West Virginia	296	1	25.83	1

[a]Four subarea consumer price indices were derived from four area indices for nonmetropolitan areas (populations of 2,500-50,000). An index for one city in each of the four areas was included to establish the subarea indices. The four area indices carried a weight of two-thirds, while the city indices carried the remainder. Indices adapted from Monthly Labor Review, August 1973, p. 72.

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Using the Automatic Interaction Detection (AID) Model to Obtain Homogeneous Classifications of Farmland Markets

By Ivery D. Clifton

Most data on the market value of farm real estate are presented on the basis of national aggregates. Though continuing to serve many useful purposes, such data have limited use when more exacting economic analysis is required. Data are needed that more accurately reflect local market responses. Thus, an automatic interaction detection model was used to group counties on the basis of their similarity across selected farm and nonfarm factors into optimal farm real estate submarket areas. Through use of the model, factors are identified and examined that help to discriminate between both local markets and variations in land values.

Keywords: Farm real estate; market; submarkets; market value; farm and nonfarm factors; automatic interaction detection model.

For purposes of economic analysis, farmland market areas have historically been defined on the basis of contiguous geographic boundaries such as States and selected regions, and for the Nation as a whole. The U.S. Department of Agriculture and other institutions have, using such a base, collected, maintained, and published data on land values and related subjects for over a century (*7*).[1] These data have been used by researchers in many empirical studies of the land market and by private and public agencies in decision-making (*8, 11, 12, 15, 16*). The common assumption has been that such data represent a single and homogeneous market area.

However, farmland market areas seldom, if ever, follow commonly defined aggregate geographic boundaries. Rather, many varied submarkets exist within the "aggregate" market area, as evidenced by the substantial variations in land values across the country, within States, and even within local communities. Barlow (*4*) concludes that what is often referred to as the "real estate market" actually comprises a conglomerate of thousands of smaller markets operating in different geographic areas for different types of property. Focusing exclusively on the farm real estate market, Scofield states: "Instead of a single market or closely integrated markets, land transactions occur in hundreds and possibly thousands, of local markets, with no standardization, little exchange of information and a minimum of competitive bidding" (*18*). Therefore, market data aggregated across diverse areal units can be and often are poor indicators for use in assessing and forecasting local market activity.

In addition, demand for land and its services is influenced by differences in productivity, climate, location, and economic activity. None of these elements is necessarily confined to or contained within specific geographic areas. Thus, the usefulness (validity) of farmland market areas defined on the basis of aggregate geographic areas is limited.

To forecast future land prices in specific areas and to explain local variations in farmland values require the use of specialized models to define homogeneous farmland market areas. Such a market classification system could supplement current procedures for reporting land values and it could serve as a basis for constructing indices that more accurately measure local changes in values.[2]

Classification of homogeneous land markets may be beneficial in other ways besides direct land value analysis. Economic issues of land use, ownership, appraisal, taxation, and financing (capital markets) can be more accurately probed with improved market information. Wealth and equity concerns, such as the level and distribution of capital gains accruing to real estate owners, also require homogeneous market areas for sound economic analysis.

STUDY OBJECTIVES AND DATA

The primary objectives of this study are to: (1) focus briefly on some methodological and theoretical considerations in market classification and (2) explain and illustrate use of the automatic interaction detection (AID) model in defining an alternative system of farm real estate market classification.

No previous effort has been made to specify statistically optimal farm real estate market areas using multivariate criteria. Several researchers (*8, 12, 16*) have attempted to define more homogeneous market areas

[1] The census of agriculture reports county level values and other agricultural data every 5 years. For example, average size of farms, distribution of land among major uses, and tenancy.

[2] The term "market" as used in this study denotes the grouping of homogeneous counties, those with similar characteristic effects on farmland. Counties assigned to a particular group or market area may not necessarily be contiguous.

subjectively. These studies share some common weaknesses, discussed in the section on methodological considerations.

Data used in the current study are county level observations, primarily from the 1959 and 1969 Census of Agriculture and the 1960 and 1970 Census of Population for the Lake States, Corn Belt, and Northern Plains regions.[3] Throughout the analysis, 1959 and 1960 data have been paired, as have 1969 and 1970 figures. Since the county is the primary unit of observation, many needed factors are not available. For example, rents, number of transfers, and capitalization rates are not reported for counties. The absence of such factors certainly affects the results of the study. However, factors that could be included in the analysis—gross sales of farm products, average size of farm, percent of cropland, density of population, and percent of county population urban—appear sufficient to demonstrate the use of the AID model in market classification.

METHODOLOGICAL CONSIDERATIONS

Many methodological problems are encountered in segmenting homogeneous market areas. Foremost, there is no accepted approach to market areal segmentation. Claycamp and Massey (*6*) argue that segmentation (not necessarily of land) must be viewed as an aggregation process, starting with micro-organizations and building up to the desired macro-level unit. Others maintain that segmentation begins with disaggregation, that homogeneous submarkets should be delineated from the aggregate heterogeneous space. Claycamp and Massey's approach has the greater appeal for land market studies. The large amount of data at the county level are readily available to help delineate the aggregate market into submarkets. Disaggregation below the county level would be desirable because land values vary widely within counties but data by township or census tract are not readily available.

Another problem faced by the researcher is which delineating criterion to select. In the studies conducted by Ruttan (*16*), Corty (*8*), and Harrell and Hoover (*12*), a univariate criterion was used. But since a multitude of different factors generate local variations from the aggregate market response, a multivariate criterion appeared to be needed to achieve meaningful market segmentation. Basically, with the AID technique, agricultural, demographic, and economic factors are jointly employed to assign counties in the study to different market areas.

THE DECISION MODEL

The AID model as developed by Sonquist and Morgan (*22*) is a cross-classification or configuration analysis which predicts and classifies by using patterns of independent variables.[4] Up to 63 explanatory independent variables can be entered into the model as interval codes containing fewer than 31 categories (codes). For example, income is entered as 1 equals less than $500, 2 equals $500-$999, 3 equals $1,000-$1,499, and so on. No codes are required for the dependent variable, which is assumed to be continuous.

This analytical technique has been used primarily in nonagricultural marketing research. Assael (*3*) used AID to segment markets by group purchasing behavior. For Newman and Staelin (*13*), it helped them analyze differences in buyer decision time. Support for the use of the AID model in this capacity is rooted in the theory of market segmentation developed by Smith (*27*). Carmen (*5*) and Armstrong and Adresss (*2*) used AID to develop consumer purchasing behavior models. Their use of the technique is analogous to the activity of a researcher investigating a body of data with only a minimal amount of theory concerning what variables are important.

Assumptions and Analytical Procedure

Because the AID technique predicts via pattern variables instead of linear functions, restrictive assumptions of linearity and additivity common to regression analysis pose no problems.[5] The algorithmic procedure used in AID permits the relationship between the dependent variables and the independent variables to be nonlinear. Further, the relation can have multimodal distributions or nominal scaled independent variables. Since each split of the data is conditioned on a prior one, the model is able to detect and handle interaction effects as well as causal priorities.

The logical step using AID is to partition a sample of observations (counties in this study) into "optimal" sets of nonoverlapping submarkets; the intent is to explain the variation present in the dependent variable. The "optimal" partitioning of the set of explanatory independent variables is said to exist when the categories defined explain a larger share of the variation in the dependent variable than is possible with any other set of submarkets.

Stated as a computation strategy, the analysis proceeds according to the following series of decisions:

1. Consider all counties as constituting a single market area.
2. Choose an unsplit market (ith), composed of $j = 1, 2, 3 \ldots N_i$ counties, which account for the largest

[3] The study area includes all counties in the States of: Michigan, Wisconsin, Minnesota, Ohio, Indiana, Illinois, Iowa, South Dakota, North Dakota, and Kansas.

[4] The term pattern denotes a class of recently developed techniques which predict by creating selected dichotomous and trichotomous splits on the data. The splits are chosen so as to minimize the total error sum of squares around the dependent variable. Common among models that fall into this class are AID, THAID (Theta-AID) interaction detection), and MAID-M (monitored automatic interaction detection). For a discussion of these models, see (*10*). Models of the above class are distinct from those such as regression, canonical, discriminant analysis, and other types which predict exclusively by creating linear functions.

[5] The problem of linearity can be overcome in regression analysis through dummy variables and transformations. Hence, additivity is the most crucial limitation.

reduction in error sum of squares (TSS_i) for the dependent variable, Y. This decision is satisfied by equation

$$(1.0) \quad TSS_i = \sum_{j=1}^{N_i} X_j^2 - \frac{\left[\sum_{i=1}^{N_i} X_j\right]^2}{N}$$

3. Determine which of the submarkets (n_1 or n_2) has the largest unexplained sum of squares (SS) and is therefore to be investigated next for a further partitioning. Here, the algorithm searches each of the X_j independent variables, determining the partitioning that will provide the largest reduction in SS for the dependent variable. The X_j independent variables and splits between categories of X's are chosen so as to split the sample into two nonoverlapping submarkets. This search procedure is repeated across each submarket formed. The between sum of squares (BSS) of the resulting submarkets is computed using

$$(2.0) \quad BSS_i = (n_1 \bar{x}_1^2 + n_2 \bar{x}_2^2) - N_i \bar{X}_i^2 \quad \text{where}$$

n = size of split submarket
N = size of total sample ($N_i = n_1 + n_2$)
x = mean of the explanatory variable for the split submarket
X = mean value of the explanatory variable for the total sample

The BSS of each explanatory variable is computed and divided by the TSS of the market to be split. The explanatory variable with the largest ratio (BSS_i/TSS_i) is chosen to split the market into additional submarkets unless constrained by one of the following three stopping rules:

(1) Sample size—Each submarket must contain a minimum sample size to be eligible for further splitting. (A minimum sample size of 15 was used in this study.)
(2) Split eligibility criterion—A submarket must contain a minimum percentage of the total original sum of squares if it is to be further partitioned. This criterion prevents submarkets with little variation from being further split. (The split eligibility criterion was set at .02 in this study.)
(3) Split reducibility criterion—This criterion is invoked when none of the explanatory variables sufficiently reduces the unexplained sum of squares. The size of the BSS for the ith market must be a minimum percentage of the TSS. (The split reducibility criterion was set at 1.0 percent in this study.)

Actually, there are two methods of entering a variable in AID models. Explanatory variables are classified either as free or monotonic, depending upon whether the researcher desires to have the coded values of the independent variables maintained or rearranged during the partition process. In monotonic AID, the class value (0, 1, 2, 3 . . . 31) is maintained during the partition scan. This type of AID analysis is intended for use with independent variables which are ordinary scales or which consist of class interval codes. Since it was hypothesized that changes in the independent variable varied directly with changes in the dependent variable, monotonic AID was selected for use in this study. (All references to AID in this study are to the monotonic form, unless otherwise specified.)

The independent variables in free AID are permitted to be rearranged to find that partition which maximizes the error sum of squares between the two subgroups formed. The free AID model is developed for use with nominal scales, or for situations in which the researcher desires not to constrain the classes which are to be placed together in the resulting subgroups. The developers of the model caution that free AID can give idiosyncratic splits because of the large number of possibilities considered during the partition scan.

Limitations

A limitation of the AID technique is that it requires a large sample. The model developers suggest that the sample size be at least 1,000, particularly where prediction is sought. However, Sheth (*20*) has found that a sample size as small as 100 can be used with satisfactory results, providing that the reducibility criterion is properly adjusted.

Another disadvantage of AID is that it focuses exclusively on determining the "importance" and not the "significance" of variables.[6] The likelihood that another sample would give the same results can be estimated by viewing the competitive possibilities at each split, but the probability of replicating the results in full is negligible. Sonquest and Morgan (*22*) indicate that tests of significance are inappropriate in AID. Hence, one must use other multivariate techniques in conjunction with AID to establish the significance of variables.

Sheth (*19*) argues that, since the AID model relies on a local optimization strategy in which a latter result is conditional upon a prior one, ordered bias is introduced into the analysis. Though introduction of such a bias could be a problem, it is no more of one in AID than in stepwise regression. Andrews, Morgan, and others (*1*) find no evidence to support Sheth's claim.

[6] The model focuses on searching data for an optimal model. Theory is involved in the selection of explanatory variables, their hierarchical rank, and interpretation of the results.

Comparison with Other Classification Techniques[7]

The primary difference between AID and techniques which predict via linear functions has previously been discussed; that these other techniques impose restrictive assumptions. Contrary to popular belief, regression analysis does not provide the same results as AID.[8] How does the AID method differ from cross-classification, cluster, and hierarchical grouping methods?

AID is an extension of cross-classification analysis, which, at best is a bivariable analysis. Yet many situations exist (as in this study) where a multivariable method extending beyond two-variable classification is needed. AID can handle up to 63 variables.

Several differences exist between AID and cluster analysis. The latter method does not seek to determine groups on the basis of their value on a single variable. Instead, it derives groups which simply exist in the dimensionality considered by virtue of their own density in the '*n*-space'.

Although many different algorithmic procedures are used in cluster and hierarchical grouping methods, these techniques invariably rely on hueristic algorithms.[9] Hence, these methods contain no sampling theory for statistical inferences or validation procedures to insure that the resulting clusters are, in fact, true invariant. Sheth (*20*) and Lance and Williams (*24*) have labeled such techniques as essentially trial and error methods. For this study, a technique was desired that provided some measure of statistical reliability concerning markets derived.

Variables Used

A multitude of different factors generate local variation divergence from the aggregate market response. Economic theory suggests that expectations of future earnings are important in the valuation of an asset. For farmland, such expectations may be based on soil productivity levels and resulting net rents. However, expected land use changes may be equally important. Thus, both farm and nonfarm factors influence land values. Since these factors are not constant over space, different demands and, hence, different markets emerge for land and its services.

It is hypothesized in this study that many of the factors (farm and nonfarm) previously used to explain variations in farmland values are important in defining alternative market areal units. The following variables were used in the model to search for an optimal market classification:[10]

X_1 = Average value of farmland and buildings per acre (dependent variable)[11]
X_2 = gross sales of farm products per acre (dollars), 1969
X_3 = average size of farm (acres), 1969
X_4 = percentage change in the number of farms, 1959-69
X_5 = percentage change in cropland acres, 1959-69
X_6 = percent of cropland in farms, 1969
X_7 = percentage change in the number of part-time farms, 1969
X_8 = percentage of farmers working 100 or more days off-farm, 1969
X_9 = density of population (per square mile), 1970
X_{10} = change in population density, 1960-70
X_{11} = percent of county population urban, 1970
X_{12} = change in percent of urban population, 1960-1970

EMPIRICAL RESULTS

Results of the AID model appear in the table and the figure. The table shows variables selected by the model as primary discriminators of farm real estate markets. The relative importance of these variables and other related statistics are also presented. The figure provides a more detailed configuration of markets classified than is shown in the table.

Strategy Variables in Classifying Optimal Market Areas

Only four of the explanatory variables were found to be important in defining an overall optimal market classification system. Gross sales of farm products per acre (X_2), average size of farm (X_3), percent of cropland in farms (X_6), and density of population per square mile (X_9) jointly explained 72 percent of the total variation in farmland values (table). They are termed the principal discriminators. As expected, farm-related factors had a dominant role in explaining variation in values since the study area is primarily agriculturally oriented. These factors (X_2, X_3, and X_6) accounted for 61 percent of the total explained variation—56, 2, and 3 percent, respectively. Density of population, a nonfarm variable, explained 11 percent of the total explained variation. Clearly, the nonfarm factor is important in explaining variations in land values, even in a predominantly agricultural area.

[7] The following discussion is not intended to suggest that AID surpasses all other available techniques. Obviously, the relative usefulness of any technique is influenced by the objective of the researcher. However, for the purpose of this study, AID appears to be more useful than other techniques that attempt similar tasks.

[8] The reader who is interested in the difference between AID and regression should see (*2, 9*).

[9] For a discussion of cluster and hierarchical methods, see (*22, 23*).

[10] The economic rationale for including these variables are determinants of farmland values is presented in (*8, 11, 12, 15, 16, 17*).

[11] Variables X_2-X_{12} were used as explanatory independent variables. All variables are measured on a county basis.

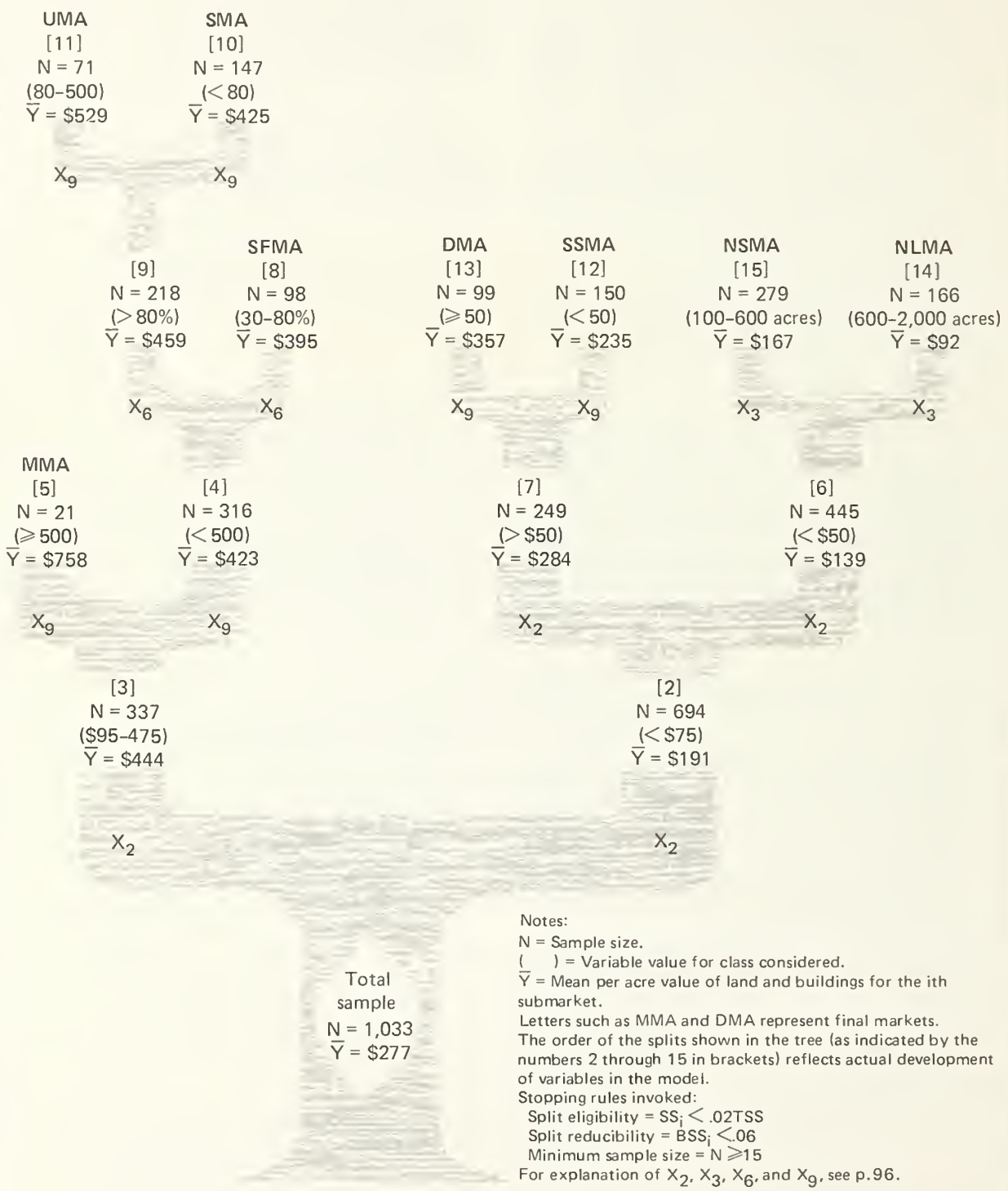
Table—Monotonic AID analysis of homogeneous farm real estate market areas, 1970

Market split on	Market number split into	Sample size	Explanatory variables	Mean value	Standard deviation	Total sum of squares	Variable value	Between sum of squares	Percentage of variance explained
				Dollars	*Dollars*	*1,000*		*1,000*	*Percent*
	Total sample:	1,033		277	178	32,860			
1	2	694	Gross sales of farm	191	107	8,030	95-475	15,174	46.2
	3	337	products per acre, dollars, 1969	444	155	8,063	<95		
3	4	316	Density of population	423	123	4,811	>500	2,216	6.7
	5*	21	per square mile, 1970	758	227	1,035	<500		
2	6	445	Gross sales of farm	139	63	1,799	>50	3,339	10.2
	7	249	products per acre, dollars, 1969	284	107	2,892	<50		
4	8*	98	Percent of cropland in	385	92	835	>80	901	2.7
	9	218	farm, 1969	459	119	3,076	30-80		
9	10*	147	Density of population	425	99	1,455	80-500	521	1.6
	11*	71	per square mile	529	125	1,099	<80		
7	12*	150	Density of population	235	76	855	>50	886	2.7
	13*	99	per square mile	357	108	1,150	<50		
6	14*	166	Average size of farm,	92	101	168	100-600	582	1.8
	15*	279	acres, 1969	167	61	1,049	600-2000		
								25,213	71.9
								F = 422**	

* Final markets.

** Significant at .01 level.

MONOTONIC AID TREE



Notes:
N = Sample size.
( ) = Variable value for class considered.
$\bar{Y}$ = Mean per acre value of land and buildings for the ith submarket.
Letters such as MMA and DMA represent final markets.
The order of the splits shown in the tree (as indicated by the numbers 2 through 15 in brackets) reflects actual development of variables in the model.
Stopping rules invoked:
Split eligibility = $SS_i < .02TSS$
Split reducibility = $BSS_i < .06$
Minimum sample size = $N \geq 15$
For explanation of X_2, X_3, X_6, and X_9, see p.96.

Market Areas Classified by the Monotonic AID Method

The principal discriminators of farm real estate markets (X_2, X_3, X_6, and X_9) were used as criteria for assigning each county to a particular market area. Eight different market areas resulted from the cross-classification (see figure). Labeled on the basis of their relative position in the urban hierarchy, these market areas are arbitrarily designated as: (1) metropolitan (MMA), (2) urban (UMA), (3) semiurban (SMA), (4) surburban-rural fringe (SFMA), (5) densely settled rural (DSMA), (6) sparsely settled rural (SSMA), (7) noncommercial small farm (NSMA), and (8) noncommercial large farm (NLMA) real estate market areas. Two questions can now be addressed. What are the intrinsic or inherent characteristics of these market areas? Are farm factors important in classifying market areas near urban areas?

At the uppermost branch of the AID tree (see figure), the MMA's comprise those counties that averaged between $95 and $475 in per acre gross sales of farm products in 1969 with a population density of at least 500 per square mile in 1970. Population density was the primary discriminator for the MMA, reflecting the strong nonfarm demand for land in urban areas. About 2 percent of all counties fell in the MMA category. These were primarily counties with the large cities and with less than 25 percent of their area classified as land in farms. The mean per acre value of farmland in the MMA's was $758—$481 per acre higher than the overall average value in the study area.

It is frequently hypothesized that economic activity (nonfarm) drives the price of farmland above its farm use or agricultural productivity value. Thus, in areas with less nonfarm economic activity, the market value of farmland should tend to progressively diverge toward its farm value. The characteristics of the UMA's and SFMA's identified in the study provide some support for such a hypothesis. That is, these two market areas are identical except for differences in level of economic activity. Further, it is assumed that density of population is a close proxy for level of economic activity.

Both market areas—UMA's and SFMA's— have per acre gross sales of farm products ranging from $95 to $475, and more than 80 percent of their farmland in cropland. Population density ranged from 80 to 500 per square mile in the UMA counties and it reached less than 50 per square mile in the SFMA counties. The average per acre value of farmland was $102 higher in the UMA than in the SFMA counties. Based on mean market values, these findings support the hypothesis that increasing economic activity in an area generally results in a widening divergence between the farm use value and current market price of land in farms. An analogous observation was made for the DSMA's and SSMA's.

Population density, the nonfarm factor, is therefore suggested as an important variable influencing the market value of farmland. Deriving suitable elasticity estimates for such a parameter may be one fruitful area for future research.

About half (43 percent) of the counties in the study were classified in the two lowest valued market areas (NSMA and NLMA). Because "average size" of farm was the prime discriminator variable for these markets, the nonfarm variable "density of population" was not important. Counties classified in the NSMA's had per acre sales of farm products averaging less than $50 and an average farm size ranging from 100 to 600 acres. Counties in the NLMA's had identical characteristics to NSMA counties except that the size of farms ranged from 600 to 2,000 acres. For both types of market areas, farm size is negatively related to the average value of land per acre, although the locational aspect may also be important. The computed F-statistic for these market areas was 422, significant at the .01 level.

CONCLUSIONS

The AID model was useful both in demonstrating the interaction between variables and in identifying the principal discriminators of each market area. Certain factors were not important in discriminating: percentage change in number of farms (X_4), percentage change in acres of cropland (X_5), percentage change in number of part-time farms (X_7), percentage of operators that worked 100 or more days off-farm (X_8), change in population density (X_{10}), percent of county population urban (X_{11}) and change in percent of urban population (X_{12}). An untested hypothesis is that these factors are also not important in explaining variations in the level of farmland values.

Substantial improvements could be made in the model if more adequate data were available. Specifically, statistics on agricultural rents, numbers of transfers, and capitalization rates are needed. These variables tend not to be available below the State level. While density of population is a composite measure of economic activity, this variable may not be the only or most appropriate proxy. Retail sales density could be a more appropriate choice for local economic activity, and numerous other variables might also be considered.

The tree diagram of the AID technique output permits visual perception and understanding of the intermediate processing of the data. Researchers and other decisionmakers can identify from the AID tree the prime discriminating factors of the markets defined. They can also identify variables that interact with these discriminators. Assuming that the stopping rules used in the model were properly set, the discriminators identified can be used with assurance of statistical significance to aid in developing regression and other multivariate techniques which might further highlight the rational functioning of local land markets.

However, additional factors (farm and nonfarm) are needed to improve the overall specification of the AID model because of the rather large (28 percent) unexplained error variance in the study. Since counties can

be and often are as heterogeneous as States and larger areas, a unit of observation smaller than the county might lead to a more efficient system of market classification. Currently, the possibility of using the "farm unit" as a criterion variable is being considered. That is, individual farms instead of counties would be classified to specific market areas. Data available from the 1970 Special Agriculture Finance Survey offer some possibilities. The primary drawback, however, is that access is lost to the nonfarm factor, density of population. Whether a suitable proxy or proxies for economic activity can be extracted from the survey is not clear at this time.

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What Do Successive Frequency Distributions Show?

By Ronald L. Mighell

Comparisons of successive frequency distributions may be made in two distinct ways that are frequently confused. One way is to make comparison against a given set of class intervals covering the relevant range of the data. The result is a fixed frame of reference, a single classification grid. The other way is to compare "corresponding relative parts" of the frequency distributions—the quartiles, deciles, or similar scale orderings. Such scale orderings, in effect, adjust the class intervals for each distribution so that they are keyed to the central tendency of that distribution. This analysis uses data on stature of fathers and their sons to illustrate the confusion that can occur.

Keywords: Frequency distributions, changing frequencies, stature, size classes.

The purpose of this paper is to throw some light on an overlooked corner of economic analysis. Many public and private agencies commonly classify data on size in terms of current period size, and then draw conclusions as to size changes between periods. That this procedure may often lead to erroneous conclusions because it does not follow identical groups through time first caught my attention several years ago in a short study of concentration in farming (*4*). Recently I came across some data from another field that may help us avoid some preconceptions and bring out the essential elements with fewer complications.

THE EXAMPLE

Join me in looking at some venerable numbers on the stature of fathers and their sons (table 1 and fig. 1). These data are from Yule's *An Introduction to the Theory of Statistics* (*7*). He borrowed them from an earlier (1903) paper by Karl Pearson. For simplicity, I have combined some of Yule's classes and rounded his fractional frequencies. Yule used the data to illustrate correlation analysis. I use them to illustrate two ways of comparing successive distributions.

The distributions, as aggregate entities, show that the sons were slightly taller than their fathers. This is perhaps more evident in figure 1, which shows how the distribution of the sons has moved to the right of that for the fathers. Table 1 also shows that the number of sons expressed as a percentage of the fathers for each height class becomes progressively greater as one goes up the size scale. They rise from 33 to 370 percent.

Some observers have inferred from this that the sons of tall fathers show progressively greater increases in stature than the sons of short fathers. There is no question about the arithmetic, but the inference is a mistaken one. The percentages are correct for comparing changes in the contents of the size classes in a given classification scheme, but not for measuring what happened between the two generations in terms of changes in corresponding relative parts of the population distributions. By corresponding relative parts, I mean quartiles, deciles, percentiles, or similar scale orderings. Such orderings refer to the central tendency of each distribution rather than to a single classification grid according to which the two distributions may be defined.

Table 1. Frequency distributions of statures of British fathers and their sons[a]

Stature	Fathers	Sons	Sons as a percentage of fathers
Inches	*Number*	*Number*	*Percent*
57.5-59.5	3	0	---
59.5-61.5	12	4	33
61.5-63.5	50	24	48
63.5-65.5	157	100	64
65.5-67.5	279	237	85
67.5-69.5	295	323	109
69.5-71.5	194	236	122
71.5-73.5	78	105	135
73.5-75.5	10	37	370
75.5-77.5	0	8	---
77.5-79.5	0	4	---
Total	1,078	1,078	100

[a]Adapted from table III, p. 160, G. Udny Yule, *An Introduction to the Theory of Statistics.* Charles Griffin and Co., Limited, London, 1929.

THE EXPLANATION

The explanation of the error in the preceding inference is simple enough, once it is perceived. Technically, the error involves the shape of the frequency distribution and where it is moving. The possibility for such miscon-

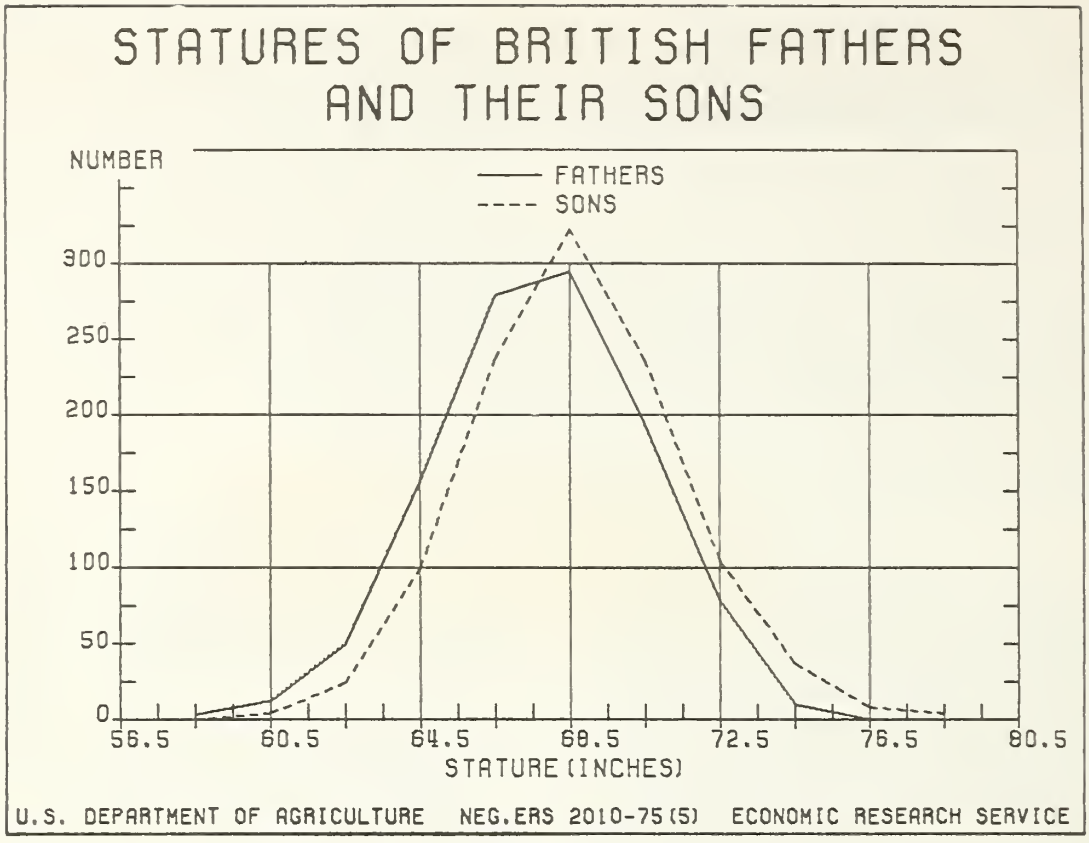

Figure 1

ception is most striking for the bell-shaped normal frequency distribution. But it is also significant for any convex-upward distribution, even in the presence of considerable skewness and distortion.[1]

One clue to understanding is the point of intersection of the frequency curves (fig. 1). Every size class comparison to the left of that point has fewer sons than fathers; every comparison to the right has more. But for each size class of fathers, the corresponding part of the sons' distribution is slightly taller. The aggregate distribution for the sons is about 0.8 inch to the right of that for the fathers; that is, the sons averaged this much taller than the fathers. If the distribution for the fathers is moved over that much and superimposed on the distribution for the sons, the coincidence is very close throughout. Table 2 shows the frequencies as read from the fathers' curve after such a superimposition. Except for minor differences the two curves are highly congruent.

Why did the sons grow taller than their fathers? First, not every son is taller; some are shorter. Yule's original distributions in a correlation table make this clear. There is a scatter, but the verdict of the averages is that the sons are taller. Not much is known about the history of the data, so we can only surmise that the sons' greater stature resulted from favorable background changes in the last part of the 19th century. These probably included improvements in nutrition, disease control, and other environmental factors.

Table 2. Frequency distributions of statures of British fathers and their sons and of the fathers' curve as superimposed on the sons' curve[a]

Stature	Fathers	Fathers' curve superimposed[a]	Sons
Inches	*Number*	*Number*	*Number*
57.5-59.5	3	0	0
59.5-61.5	12	8	4
61.5-63.5	50	35	24
63.5-65.5	157	113	100
65.5-67.5	279	235	237
67.5-69.5	295	290	323
69.5-71.5	194	235	236
71.5-73.5	78	119	105
73.5-75.5	10	37	37
75.7-77.5	0	6	8
77.5-79.5	0	0	4
Total	1,078	1,078	1,078

[a]Frequencies shown in column 3 obtained by reading from figure 1 after superimposing the fathers' frequency curve on the sons' curve by moving the fathers' curve to the right 0.8 inch.

[1] A concave-upward (U-shaped) distribution will give exactly opposite results, but this type of distribution is not common.

EXPANDING AND CONTRACTING SECTORS

Some analysts have referred to the two parts of the distribution indicated above as the "expanding and contracting" sectors.[2] This phrasing is intriguing but may be misleading, because it defines sector in terms of the classification scheme instead of in terms of corresponding relative parts of the distributions of successive populations. What the definition does can be seen by imagining a freight train a mile long that passes through a tunnel of the same length. Suppose we call the part of the train emerging from the tunnel sector A and the part in the tunnel sector B. As the train moves ahead, sector A is continually expanding and sector B is contracting. We are defining sector in terms of a single classification scheme. The train itself and its makeup remain unchanged. No harm is done, because we know how sector is defined and the continuity of the train is understood. But if we should define sector in terms of the composition of the train itself, and call the first half of the train, sector A, and the second half, sector B, we would have another situation.

Most instances of successive distributions are less closely connected than the cars in a train, and there is more opportunity for confusing the two kinds of sectors.

TWO WAYS OF COMPARING FREQUENCIES

So long as we consider a single distribution at one time or place, no problem arises because the two ways are essentially identical. But the moment we compare one distribution with another, two different ways appear. Do we want to compare parts of the same classification grid or do we want to compare corresponding relative parts of the populations? We may wish to do either or both. What we must not do is mix them up and draw wrong conclusions. Each approach has a valid use as long as it is kept separate.

For example, distributions like those in table 1 would be useful to a manufacturer of readymade clothing. He would like to know how many suits might sell in each size class for sons and for fathers separately. His operations depend on information keyed to such distributions. Similarly, a farm machinery manufacturer plans his projections of tractor and machine sizes against information on changes in farm sizes, because these affect the demand schedules he tries to meet.

But many situations involve comparisons between corresponding relative parts of successive populations. Persons using analysis-of-income data make such comparisons, and income specialists are accustomed to making quartile and decile comparisons between different population groups and between different nations. From such measurements they can form some idea of relative concentrations of income among populations widely different in income scale.

[2] Nikolitch was apparently the first to use these terms in his analysis of changes in sizes of farms (*5*).

In opening his discussion about the expanding and contracting sectors of American agriculture, Nikolitch had this to say:

> The total number of farms in American agriculture has been declining for more than 20 years. Yet the number of larger farms is increasing while the number of smaller farms is decreasing rapidly. Thus American agriculture has an expanding sector of large farms and a contracting sector of relatively small farms (*5*, p. 1).

Nikolitch recognized that ". . . the concentration of production in the expanding sector of agriculture is due in large measure to the increase in the number of such farms . . ." brought about by smaller farms increasing in size and moving up the size scale. But he sometimes seemed to forget this relationship; and many readers have misinterpreted the findings, assuming that the large farms are increasing in size more rapidly than the small farms.

In comparing changes in relative size distribution of commercial farms in the United States from 1959 to 1964, I found that, despite a considerable drop in numbers of farms and increase in size of farms, the relative size distribution had not changed greatly (*4*). The truth seems to be that, on the average, farms in all size groups as of any given base period have been growing larger at roughly the same rate, in the same sense that the British sons in our illustration were growing taller in all groups. Similar findings for 1939 and 1964 are presented by Charles L. Schultz in his analyses of census data (*6*). The fact that there has been a dramatic reduction in the total number of American farms in the last 30 years means, of course, that farming is absolutely more concentrated and in fewer hands. But it does not mean that relative concentration within the distribution has changed appreciably. The top 20 percent of the farms may still produce about the same percentage of the farm output.

The useful series on number of farms by value of sales classes is sometimes misinterpreted in the same way (*2*). For example, consider the two pie charts in figure 2, which appeared in the July 1975 *Agricultural Outlook* (*1*, p. 21). The accompanying discussion says that "rapid changes are taking place in the structure of our Nation's agriculture, as evidenced . . ." by changes in the distribution of farm numbers and gross and net income measures by value of sales classes. It goes on to point out that large increases in numbers and sales in the larger sales classes took place between 1960 and 1974. But it neglects to say that the greater part of the change is due to inflation and it takes no account of the probability that the two distributions if compared by percentiles are probably not much different.

CONCLUSIONS

Thus, two distinct ways exist to compare successive frequency distributions. Each stands on its own feet; each serves a different purpose. One considers changes from the viewpoint of a single frame of reference, the

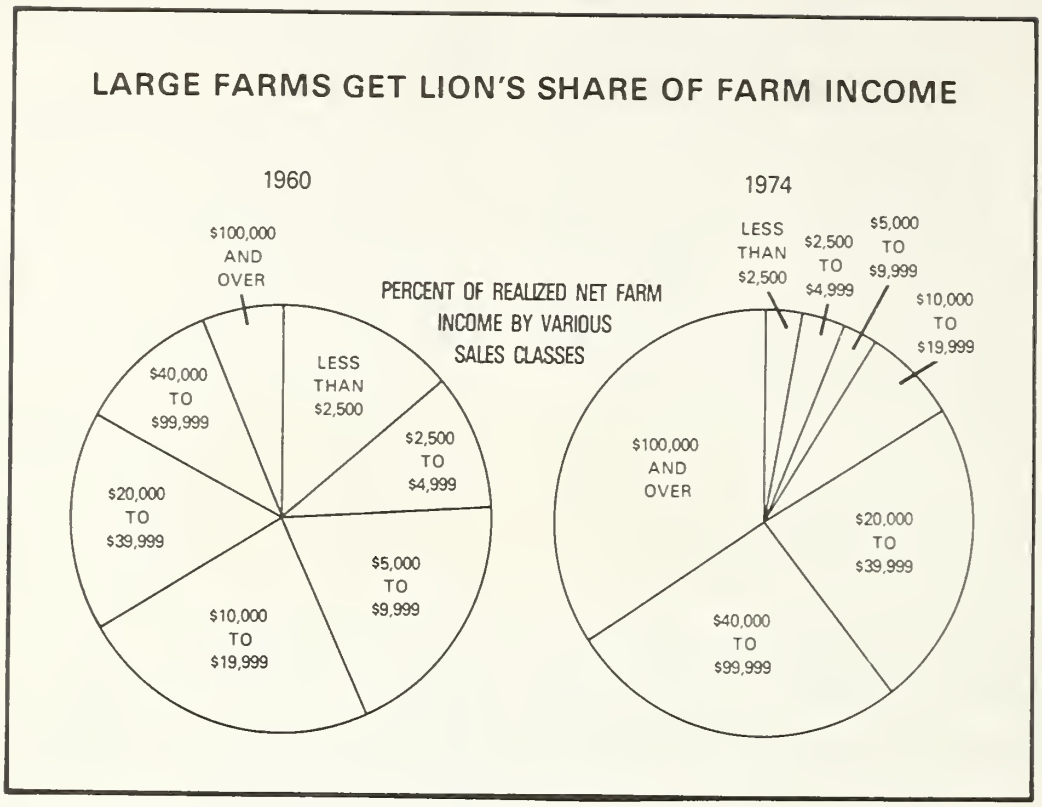

Figure 2

fixed class interval scheme of classification. The other considers changes between corresponding relative parts (quartiles, deciles, etc.) of each frequency distribution.

The examples presented illustrate the purpose and proper use of each comparison. The findings have significance in the interpretation of changes in farm size, farm income, and similar problems.

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BOOK REVIEWS

Agricultural Development: Soil, Food, People, Work

By Charles E. Kellog. Soil Science Society of America, Inc., Madison, Wisc. 233 pages. 1975. $8.75.

Several years ago I picked up a book published in 1941 to find out something about soils and land. The current volume, *Agricultural Development,* was written by the same author 34 years later. His experience and learning are evident.

Two themes run through the text:

> Without a good plan based on a study of the soils, water, and essential services, great delays and failures are inevitable.
>
> In fact, many of the greatest opportunities for increasing the world food supply and the incomes of farmers are reductions in wastes between the fields of standing crops and the kitchens.

The first theme concerns the proper use and care of the soil; the second involves development of an infrastructure for crop marketing. The market is the world, and the people considered are the technicians who work to improve agriculture in the less developed countries. The author does not describe their work so much as the problems they face, and he compiles a number of "do's" and "don'ts," mostly "don'ts," based on his own experience. As such, the book is almost required reading for anyone involved in foreign agriculture.

Despite its relative brevity, the book does not read quickly. One reason is that Kellog includes numerous sage observations; such as "here I am not arguing for that easy virtue of tolerance but for that far superior virtue of appreciation." It takes time to savor them properly. Also, he presents ideas in a highly compact style. At times, his book reads like an epitome, a concise digest of the subject matter. He covers a wide area, ranging from a discussion on clear-cutting to one of the Green Revolution, describing the latter in a third of a paragraph. We have all heard of soil erosion, but who is acquainted with the opposite condition, water logging? Kellog explains a subject for us often by approaching it from the aspects less readily known to the reader. The practical value of the book is tremendous, representing, as it does, a broad assessment of agricultural development in the less developed countries. And if Kellog doesn't discuss a matter himself, he refers to it and to a leading authority on the subject.

Kellog does seem overly optimistic, however, when he writes that potentially 1.8 billion hectares of arable soil can be added to the 1.4 billion currently in use. He mentions factors that would dilute or negate the value of the added land but does not seem to relate them. "The prospects of marketing some of these, especially tea, coffee, and some of the fibers, are questionable." What good does it do to raise more bananas if the market for them is already saturated? Kellog does not develop this. "The tourist assumes they [the workers] are lazy. But the tourist probably gets 3 to 4,000 calories a day, whereas the poor cultivator may not have more than one-half that." The lack of food and resulting lowered production, of course, represent a vicious cycle, which adding new land to cultivate would not remove.

If there is a weakness in the book, it is Kellog's all too frequent uncharitable references to "the very narrowly trained specialist" and "the ill prepared generalist," which seem to be his private euphemisms for incompetence. As a consequence he has set himself up as the primary authority, which of course he did not intend.

The only real flaw in the book is that the pictures were printed in black and white. Use of color photographs would have been a welcome addition.

Howard Christie

Today's Food Broker: Vital Link in the Distribution Cycle

By Daniel I. Padberg. Chain Store Publishing Corporation, 2 Park Avenue, New York, N.Y., 10016. 200 pages. 1971. $10.

Though ostensibly a book about food brokers, *Today's Food Broker* more properly describes food distribution. The beginning and ending chapters, which treat the broker directly, aptly picture the vital services such agents perform in bringing food from the manufacturer to the consumer. Padberg describes brokers as independent agents who do not take possession of the product but provide sales and merchandising services for the manufacturer throughout the distribution system. Other chapters in the book primarily consider food processing, marketing, the consumer, management, computer science, and the broker's function in each of these areas. The sections on rising income and its impact on the modern homemaker arouse interest.

Dr. Padberg's ability as a marketing man represents the main strength of the book. His precise, wide-ranging use of marketing terms in their proper context makes the material more readable. The frequent use of tables and statistical comparisons helps, but some of the indexes seem esoteric. Though the level of explanation is geared to the apprentice, those in food distribution for a number of years could also benefit from reading the book. Perhaps its main application, though, will be as supplementary reading in a marketing course.

The book provides useful history on the interplay of the components of food distribution and the broker's adaptation to changes over time. The reader comes to appreciate the importance of the broker function in food distribution to the point of wondering if wholesalers are needed. But one also wonders how the physical distribution is made after the broker has completed the sale and offered advice. An extensive list of both manufacturers' and food brokers' responsibilities in coordinating shipments and deliveries does not answer the question of how actual distribution is made.

Although the broker as an industrial entity, an impersonal link in the food distribution chain, is well defined, the broker as a human being is not. The reader looks for more observations like the one in which Padberg states that the senior members of a food broker firm will visit the wholesalers while the less experienced staff members visit the retailers. Some of the type of flavor supplied by Gerald Carson's drummer in *The Old Country Store,* a popular book, would have helped round out the picture of the food broker.

What future changes may occur in food distribution? Padberg puts forth at least one. In crowded metropolitan areas with numerous high rise apartments, there is little space for stores and parking lots. In such areas, shoppers could order and pay for food items by inserting punch cards into terminals. The goods would be promptly delivered to a receiving area in or near shoppers' homes.

Howard Christie

Water Rights Laws in the Nineteen Western States

By Wells A. Hutchins, completed by Harold H. Ellis and J. Peter DeBraal. Volume II. U.S. Department of Agriculture, Miscellaneous Publication No. 1206, U.S. Government Printing Office, Washington, D.C., 20402. 756 pages. 1974. $10.

When Wells A. Hutchins, longtime staff member of the U.S. Department of Agriculture, died on September 19, 1970, he was regarded as the foremost authority on water rights as they have evolved in the 19 Western States. He had written and spoken extensively about this subject, and his *Selected Problems in the Law of Water Rights in the West,* published in 1942, was quoted by Supreme Court justices along with the earlier legal authorities, Clesson S. Kinney and Samuel C. Wiel.

Twenty years ago Hutchins began a revision of *Selected Problems,* one that became the three-volume treatise that he had in preparation at the time of his death. Two of his departmental colleagues, Harold H. Ellis and J. Peter DeBraal, have undertaken to edit and complete the work. Volume I appeared in 1971 and it was reviewed in the January 1973 issue of this journal. Volume II is the subject of this review; the third, with an index, will follow.

The first volume treated State water policies, characteristics of watercourses, navigable waters, and the nature of the appropriative right. The second volume presents the nature of the riparian right west of the 98th meridian, and it describes the pueblo water right of California and New Mexico as well as the ancient water rights of Hawaii. Then it continues with a lengthy commentary on the protection, loss, adjudication, and administration of water rights in watercourses, reviews the law of diffused waters, and concludes with two chapters on rights in groundwater.

The 18 chapters on surface water rights are the product of a lifetime of research and study. The author relies on legislative statutes, constitutional provisions, and innumerable court decisions; occasionally, he refers to earlier treatises and journal articles. The result is the most complete and authoritative survey of Western surface water law in print.

Unfortunately, the same cannot be said of the two chapters on groundwater rights, one of which, chapter 19, was prepared by William M. Champion, professor of law at the University of Mississippi. Although chapter 19 was designed to be general, its surveys are brief, fragmentary, incomplete, and occasionally inaccurate. In a chapter of 33 pages, information concerning groundwater rights in 19 States is scattered under three headings and in some cases it is repeated in chapter 20. The review of States that have authorized the designation of critical groundwater areas omits four, including New Mexico, where the institution originated.

With respect to authenticity, Champion errs when he writes that the Arizona Supreme Court has "consistently held that percolating waters . . . belong to the owners of the soil" (p. 635); in its initial decision in *Bristor* v. *Cheatham*, the court opted for public ownership, but reversed itself in the second decision. The California court in the original decision in *Katz* v. *Walkinshaw* did not "clearly" (p. 635) reject the English rule. Quite to the contrary, Justice Jackson Temple went to great pains to point out that he was not radically departing from it. In a more serious mistake, Professor Champion declares that there is "no statutory law defining rights to the use of percolating ground water in Washington" (p. 652). The Washington legislature thirty years ago declared "all natural ground waters of the state . . . also all artificial ground waters . . . to be public ground waters and to belong to the public and to be subject to appropriation for beneficial use. . . ." (Washington, *Session Laws,* 1945, p. 827).

Chapter 20, "Ground Water Rights in Selected States," provides more accurate, detailed, and comprehensive descriptions, but for only 8 of the 19 States. It would have been preferable to have omitted chapter 19, enlarging chapter 20 to include comprehensive summaries of the groundwater laws in all 19 States. As it is, more complete surveys exist in the *Summary-Digest of State Water Laws* issued in 1973 by the National Water Commission.

Robert G. Dunbar

The Personal Distribution of Income and Wealth

Studies in Income and Wealth, edited by James D. Smith. National Bureau of Economic Research, Inc., 261 Madison Avenue, New York, 10016. Vol. 39. 568 pages. 1975. $17.50.

"Measurement without theory" is the syntactical pigeonhole into which many economists place National Bureau of Economic Research studies. Anyone of that opinion who fights his or her way through *The Personal Distribution of Income and Wealth* will have that bias reinforced.

Measurement is important for two reasons: to inform realistically and to promote or guide action. As a presentation of methodological techniques and accurate descriptions, the essays included are excellent. They present any interested reader with a solid base to begin analysis. But the lack of analysis *per se* in any of the essays or in the comments covering them is a maddening irritant; the reader is constantly left asking "so what?"

James D. Smith, the editor of the volume, is as guilty of this irritant as any of the other authors. In his essay with the scintillating title "White Wealth and Black people: The Distribution of Wealth in Washington, D.C., in 1967," Smith caps the estimates section with the following: "The data for nonblacks supports the contention that outliving one's spouse is the route to increased riches." He continues: "Among blacks, the marital-status differences in wealth nearly disappear," and concludes "Being black, as was apparent from the descriptive tabulations, is an important negative factor in wealth holding . . . . " We never would have guessed.

And then there's Boulding. While Kenneth Boulding provides the only easily readable essay of the group, the purpose of it seems to be to promote some of his other works, one of which he deigns to footnote (the other is his concept of the grants economy). But then Smith, in the introduction, told us that this essay is "characteristic Boulding."

One of Boulding's comments deserves to be challenged. He asserts that "we are apt to fall into an 'income prejudice' very similar to race prejudice. That is, we assume that because people are alike in one quality or measure, they are alike in others." This reviewer finds Boulding's intent rather curious and his comparison odious. Equal capacity for "enjoyment" is one of the basic premises of Western democracy; universal suffrage is rooted in the idea that every person has the equal capacity to enjoy a vote—and its consequences. If that be a "prejudice," it needs to be fostered.

The studies included in this volume will undoubtedly be presented in more depth by their authors at a later time. The casual reader might do well to wait until then to read them. Only the incurably curious researcher should approach this volume.

David R. Dyer

Spatial Sectoral Programming Models in Agriculture

By Earl O. Heady and Uma K. Srivastava. Iowa State University Press, Ames, Iowa. 484 pages. 1975. $12.95.

This book is essentially a synthesis of articles resulting from mathematical programming modeling work by Heady and his associates over the last 20 years. The modeling methodology employed is linear programming—with one exception, which involves the incorporation of linear demand equations in a quadratic programming formulation. The authors present a particular sequence of models to illustrate the systematic development of models from the more simplistic Heady-Egbert regional production adjustment model to much larger, sophisticated models. These larger models incorporate simultaneous interaction of many crop and livestock commodities, transportation, exports and imports, and policy actions; specification of farm size and soil conditions in a resource allocation framework; water resource use among competing agricultural and nonagricultural demands; and explicit consideration of optimal land use, water allocation, technological development, and soil conservation within certain environmental constraints.

The models are all massive in size, containing as many as 10,000 equations and 75,000 variables. Their size results from the inclusion of large numbers of producing regions (in some cases, one or two hundred) and a multitude of crop and livestock commodities. The authors conclude from working with such models that their size does not present much difficulty in a methodological or computational sense but mainly in the models' insatiable demand for data. This demand is currently a major stumbling block in applying this type of model to countries other than the United States, especially the underdeveloped nations.

The authors present well the objectives for building each model, the differences of each from previously constructed models, their mathematical structure, and the problems and techniques used to provide voluminous quantities of data. They describe in detail results from solving the models to analyze various policy considerations as well as the impact of changes in demand, technology, resources, and costs.

Nearly half of each chapter is devoted to analyzing particular solutions to the models. The treatment becomes quite laborious unless one is particularly interested in the specific question being addressed. Following a particular analysis becomes cumbersome unless the reader has convenient access to a microfilm viewer. Every one of the data tables has been placed on microfilm.

A major purpose of the book is to spur further use of mathematical models in other countries and more extensive development in the United States. However, a prerequisite for this type of model building overlooked by the authors is the training and development of the model builders. The book could have been much more useful to potential model builders if the senior author

had shared some of his experience and insights involving the model development process.

For example, some questions which go unanswered are: What type of analytical software system should be developed to facilitate such massive model structures? What are the tradeoffs between building simplistic, less costly models versus obtaining "realistic" results? What procedures should be used to properly validate models? What cost and resource requirements can be expected in building similar models? What aggregation problems should one expect to encounter and how might they be handled?

In short, the book provides an excellent inventory of what E. O. Heady and his associates have accomplished in the last 20 years, but it stimulates enough questions whose answers could fill another extremely useful book.

Hilarius W. Fuchs

World Food Problems and Prospects

By D. Gale Johnson. American Enterprise Institute for Public Policy Research, Washington, D.C. 83 pages. 1975. $3.

In this small volume, covering a wide spectrum of issues on the world food problem, Professor Johnson has provided a lucid layman's account of recent events on the world food scene and his personal views on prospects for the years ahead. He has seasoned his paper with references to many ERS reports.

A confluence of events brought about the crisis of 1973: the poor harvests of that year in several major producing regions, the USSR decision to go into the world grain market to make up its needs rather than absorb the shortages, the shortfall of the Peruvian anchovy catch, and increased affluence in many countries during the past decade that has brought a consequent upgrading of diets. But most of all, Johnson blames the sharp increase of grain prices on government policies which limited demand adjustment to shorter supplies to the price mechanism. While his analysis is appropriate for countries like the USSR, it is less appropriate for the poor in developing countries who would suffer further deprivations if their ration of grain were suddenly to cost substantially more. Johnson rejects the view that the affluent in some countries pose a threat to the poor in others because the well-to-do consume (directly and indirectly) a disproportionate share of the world's grain supplies.

"Are high farm prices here to stay?" Johnson asks. Citing data which indicate that there has been a long-term trend toward lower grain prices, he says he does not believe the events of 1973 signal a reversal of that trend. Here, Johnson differs from views of Lester Brown and Dale Hathaway, whom he cites in this respect. Johnson takes the position that while he believes farm prices will undoubtedly reflect higher land and input costs, including energy, he deprecates their impact. The *real* price of grains received by farmers will fall as supplies become more ample, he argues, naming the price declines of early 1975 as support.

Professor Johnson also tackles the question of grain reserves and examines the relationship between stocks and prices, citing ERS reports. A worldwide system of grain reserves is sought, he concluded, because governments do not permit free trade in grains and do not let market prices allocate world supplies. His observation is partially correct, but it fails to consider the concern of poor countries that they will be priced out of the market by the more affluent nations. Johnson does list three reasons why reserves might be useful for the United States: (1) to meet emergencies in developing countries; (2) to foster trade by helping convince importing countries of assured supplies; and (3) to absorb variations in commercial export demands—particularly if the Soviet Union continues to be an intermittant and large-scale importer.

In a wide-ranging chapter on increasing food production in the developing countries, Johnson says they have great potential for expanding food production. But he argues that the real issue is to increase per capita supplies significantly and that to achieve this goal population growth rates in these countries must be reduced. He points to the Middle East with its huge natural gas reserves as having a great potential for producing nitrogen fertilizer, the critical input to increase output. But the potential is being wasted (more natural gas is flared in the Middle East than is consumed by the entire petrochemical industry in the United States) because, he argues, peace and political stability are lacking. Hence, the large capital investments needed are not being made. It seems a little odd to the reviewer that with all the petrodollars now flowing into the region and the tremendous investments being made in countries like Iran and Saudi Arabia, that capital should be lacking for this rather obvious area of industrial development. This somewhat flawed argument appears as the lead paragraph of the press release by the American Enterprise Institute for Public Policy Research, publisher of the booklet.

The conditions necessary for increasing food production in developing countries are known, Johnson says, giving the following: more agricultural research; an adequate supply of modern inputs; improvement and expansion of irrigated areas; incentives to farmers to make the changes; and improvements in transportation, marketing, and processing institutions and facilities. But above all, Johnson concludes, it is not an absence of technology or know-how, but the uncertain commitment of governments, the lack of political will among the developing as well as the industrialized countries that threatens the prospects for increased per capita food supplies in developing countries. He fears that when world supplies become more ample, this year or next, the current mood of urgency will pass, as it did between 1969 and 1972. A more widely shared and substantially greater effort by all countries is needed—the Organization of Petroleum Exporting Countries as well as the Organization for Economic Cooperation and Development; the planned

and the market economy governments; and, most of all, the developing countries themselves. A failure to maintain the current momentum toward increased production would be a catastrophe for many millions of people.

Martin Kriesberg

Ohio Farmer

By Wheeler McMillen. Ohio State University Press, Columbus, Ohio, 43210. 220 pages. 1974. $11.

In No Time at All

By Carl Hamilton. Iowa State University Press, Ames, Iowa, 50010. 185 pages. 1974. $4.75.

When agricultural professionals like the authors of these two books write autobiographical accounts of farm life during their youth they do so within a frame of reference which makes their work particularly valuable. These two books, together with Henry C. Taylor's *Tarpleywick*, provide us with a century of coverage of midwestern farming. Taylor's book takes us from the settlement of Iowa in the 1840's to World War I; McMillen's book covers the period from 1890 to 1922; Hamilton's ranges from 1910 to 1940. All describe the period before the energy revolution took hold in American agriculture. Each family survived a severe depression. The first two families experienced periods of relative prosperity. The fact that no real prosperity existed in agriculture during the period covered by Hamilton may account for the generally depressing tone of his book. Near the end, he notes, "It has been said that at times a person of very ordinary wit can hardly avoid success, while contrarily, in other times and circumstances, a person of uncommon ability can not escape defeat." Hamilton's family lived precariously close to the line between success and defeat. After losing their farm in 1920, they lived on rented farms. Not until Hamilton's father reached retirement age had he accumulated the resources to buy another farm. By then it was too late. He was too old.

All three books abound in details describing various farm operations and family living. Many changes occurred over the years. Horse-drawn equipment improved and it became highly specialized. The railroad and the automobile arrived, creating marked changes in marketing and purchasing practices of farmers. Rural free delivery and the telephone helped to break down isolation. Farm credit developed. Science began to contribute to the art of farming. Yet H. C. Taylor's father would have been quite at home on a farm of the 1930's like the Hamilton's. And Thomas Jefferson would have been able to understand the Hamilton farm because farming still meant a way of life rather than a food factory. The authors deserve a vote of gratitude for having recorded this lifestyle in fascinating detail for future generations.

Jane M. Porter

Water Management and Agricultural Development

by Kenneth Frederick. The Johns Hopkins University Press, Baltimore, Md. 187 pages. $10.

Though Kenneth Frederick's focus is a small region in western Argentina, his findings and recommendations can be applied by persons interested in the optimal intertemporal use of many common property resources. Looked at another way, Frederick's focus is wide. He considers social, political, and economic implications of the water supply situation in Cuyo.

The economy of the Cuyo region is based on the production and processing of agricultural products, particularly grapes and wine, which account for 92 percent of Argentina's grape and wine production. Grapes account for 60 percent of Cuyo's cultivated land and 75 percent of the value of its agricultural production.

Until recently, Cuyo's supply of land and water resources was not recognized as a limiting factor to future growth. Land remains abundant but it must be irrigated for crop production. Surface water supplies fed primarily by snowmelt from the Andes Mountains and ground water pumping easily met the region's needs through the early 1960's. Since then, however, ground water pumping has exceeded normal recharge to Cuyo's aquifers. Major water infrastructure investments and a significant increase in the number of irrigation wells could not prevent substantial crop damage in the drought years of the late 1960's.

The short-term problems of 1967-72 subsided because of a doubling of the number of irrigation wells and unusually plentiful rain and river flows in 1972-73. But the longrun outlook has not changed. At one time surface water flows exceeded water use. Now, a farmer's surface water receipts are uncertain and generally insufficient for the minimum needs of land possessing legal rights to this water. Further, much of the region's agriculture depends on a diminishing supply of increasingly costly ground water.

Frederick's study focuses attention on evaluating water use efficiency under the impact of market forces and alternative government policies. While the public sector has become more actively involved since the onset of recent water shortages, it has not begun to address the long-term realities facing Cuyo's water resource.

The government response has been to enlarge the effective flow of surface water and to increase its reliability by investing in dams, canal lining, and irrigation wells. Pricing policies continue to understate the economic value of surface water. Real costs of ground water have been reduced by 50 percent or more for many farmers through subsidized agricultural credit policies, tax incentives for investing in ground water use, and favorable electric power rates. In addition, the local governments have quite successfully supported high wine prices in 1972 and 1973, thus encouraging private sector investments in the industry. Unfortunately, if recent upward trends in water use continue for another

decade, Cuyo's principal aquifers could be fully depleted shortly after the turn of the century.

Major changes will undoubtedly occur in water use patterns and economic growth by that time. They may result for several reasons, Frederick believes, including a natural reduction in supply, government controls limiting further expansion in use to protect current users, or efforts to alter current consumptive trends to promote more efficient water use. The author feels that the measures required to ensure such development are neither self-evident nor likely to be politically popular. Acceptance of a long-term policy will require marked efforts to educate vested interests that inefficient use will be detrimental to the whole region.

Recognizing the political climate, Frederick proposes a development strategy that would slow but not eliminate the excessively rapid use of ground water. It would provide greater incentive for more efficient use, but not eliminate the gap between private and public water costs. Incentives would be provided for improving the conjunctive use of ground and surface water. Measures proposed include (1) elimination of credit, tax, and power subsidies for ground water use; (2) increase in surface water costs; (3) establishment of a market on surface water; (4) research benefits and costs of new irrigation techniques; (5) a study of the merits of a user tax on ground water use; (6) establishment of a mechanism to develop and implement plans for improving the short- and long-run uses of water; and (7) strengthening of extension services to marginal farm operators.

John Sutton

Technology and Civic Life: Making and Implementing Development Decisions

By John D. Montgomery. The MIT Press, Cambridge, Mass. 239 pages. 1974. $12.50.

Those interested in and especially those involved in agricultural development in the Third World should read this book closely and at length on its systematic analysis and innovative proposals. Much of what Montgomery contributes seems to have come from the seminar on development administration he has taught at Harvard since 1962. For an interested outsider, like myself, his book is worth the price just for his review of the importance of technology in the development of Western political and economic systems, and his review and use of the abundant literature on nationbuilding.

Early in the book, Montgomery states one of his basic propositions: ". . . technology almost certainly offers the best hope of improving the quality of life in the developing countries." However, he is certainly not a technological determinist. Rather, his deep-seated anxiety is that technology, badly introduced into a Third World political culture, can be—indeed, sometimes has been—far more harmful than beneficial. The basic dilemma, then; how can modern technology be introduced into these new nations in ways which will induce and nourish the growth of a civic life both culturally and materially satisfying to the individual citizen? And, it should be quickly noted, Montgomery is not concerned only, or mainly, with the few—the elites; his principal concern is with the peasants, the urban laborers and their families—". . . the planned use of technology to serve the ideals of social justice."

Political science and economics receive a few hard knocks from the author. They are too elitist, more concerned with legislatures and bureaucracies than with those people who are presumably the legislator's constituents. And the two disciplines are too much entranced with the beauty and intricacies of macroeconomics rather than the grass roots significance of micropolitics. Anthropology, social psychology, sociology (to a lesser degree), and the experimental side of the behavioral sciences have more to offer people who are involved in development politics and administration, in the author's judgment.

Montgomery believes it quite likely that the Third World (and perhaps the First and surely the Second Worlds, too) has been overly committed to national planning, with its emphasis on coercion rather than personal participation in decision formulation and policy administration. National planning is necessary, he argues, but so is "local option" and "individual choice." Technological change is both necessary and dangerous. It may destroy the old world while creating a new world which will soon prove to be far more unattractive and demeaning to the ordinary citizen than was his or her traditional environment and culture. Montgomery seems convinced that these real dangers can be overcome if Third World governments accept as their central, guiding proposition that "*modernizing the behavior of citizens could be taken as a primary task of development administration*" (his emphasis).

The richness and breadth of the author's presentation are probably impossible to summarize, but I will cite a few examples. "Modern" behavior requires a new "rationality"; not necessarily the Western definition, however, because ". . . rationality itself is a convention." However, there are patterns of developmental behavior which will have to be culturally modified before change can be induced into the particular political culture. That is, new standards will have to be understood and adopted (regular work hours, for example). Personal investments will need to be specified and made (in education for example). Civic institutions will need to be built that are sensitive to the root causes of conflict and can develop conflict-resolving processes which provide both equity and legitimacy of rule to all the citizenry. Finally, the leadership must be found to provide the inspiration, intelligence, integrity, and skills to bring all these changes about.

To word Montgomery's major propositions in these terms, however, seems to understate his hardheaded idealism. He presents a valuable discussion of a four-sided conflict typology (product competition, process competition, intrasectoral or class conflict, and conflict with social values) and he comments on the importance of diffusion projects and the diffusion process. His discussion of the "analytical dimensions of technology systems" (size, shape, intensity, and time) also impresses the reader. Perhaps his most important contribution, at least to this reviewer, appears in the last chapter, on decisions. He discusses three types: first-order decisions (a systematic comparison of the social significance of proposed technological changes), second-order decisions ("which agency should receive the assignment to implement a new program?"), and third-order decisions (the analysis of incentive policies). These three types make up the real business of administration, the true test as to whether things will move and measurable change actually take place.

Certainly, there is room for doubt and worry about some of Montgomery's ideas. He seems to be expecting more from the Third World than the Western nations have been able to learn and practice, assuming that it would be wise for them to do so. He observes that a "systems approach [his approach] to the uses of technology calls for the integration of science, politics, and welfare factors with engineering and economics, specifically addressed at the country level." There is the real problem of "technologic misfit," to be sure, yet one wonders: might not a fair amount of this kind of misfit be preferable to even a benevolent application of such a systems approach? Moreover, one can be attracted to his discussion of and stress on the equity and efficacy of citizen participation. Yet how do such value propositions square with his judgment that "the ultimate sources of developmental change are nearly always provided by elites . . ."?

Nevertheless, this review must close on a positive note and a well-intentioned plea. Agricultural scientists can learn much from a careful reading of this study. If the Third World nations must learn, in very large part, how to feed themselves, Montgomery's basic themes should be given the most thoughtful consideration. Perhaps the new nations will find ways to adopt technology while minimizing its evils so that a democratic civic life can be gradually constructed, or where one already exists, preserved.

Ross B. Talbot

Suggestions for Submitting Manuscripts for Agricultural Economics Research

Each contributor can expedite reviewing and printing his paper by doing these things:

1. SOURCE. Indicate in a memorandum how the material submitted is related to the economic research program of the U.S. Department of Agriculture and its cooperating agencies. State your own connection with the program.

2. CLEARANCE. Obtain any approval required in your own agency before sending your manuscript to one of the editors or assistant editors of Agricultural Economics Research.

3. ABSTRACT. Include an abstract when you submit your article. The abstract should not exceed 100 words.

4. NUMBER OF COPIES. Submit one ribbon copy and two additional good copies of the article for review.

5. TYPING. Double space everything, including abstract and footnotes.

6. FOOTNOTES. Number consecutively throughout the paper.

7. REFERENCES. Check all references carefully for accuracy and completeness.

8. CHARTS. Use charts sparingly for best effect. Include with each chart a page giving essential data for replotting.

9. FINAL TYPING. Manuscripts accepted for publication will be edited and returned to author with instructions for retyping if necessary.

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